ADM.
RY

SEP 22 1933

VOLUME XXVIII No. 183

JOURNAL
OF THE
AMERICAN STATISTICAL ASSOCIATION

SEPTEMBER, 1933

CONTENTS

THE EFFECT OF THE DEPRESSION UPON BOND YIELDS. By Carl Thomas 261

A DISCUSSION OF THE ACCURACY OF AGRICULTURAL CENSUS ENUMERATION IN THE NORTHEAST. By L. G. Davis 272

THE ALLOCATION OF HIGHWAY COSTS AMONG CLASSES OF MOTOR VEHICLES FOR PURPOSES OF CALCULATING GRADUATED TAX SCHEDULES. By Arch D. Schultz 286

TESTS OF SIGNIFICANCE IN APPLYING WESTERGAARD'S METHOD OF EXPECTED CASES TO SOCIOLOGICAL DATA. By Samuel A. Stouffer and Clark Tibbitts 293

THE AMERICAN FAMILY INCOME AND PROSPERITY. By Louis Bader 306

SECONDARY CURVES AS A MEASURE OF THE LAG OR PHASE DIFFERENCE BETWEEN TWO PRIMARY CURVES. By R. Von Huhn 312

NOTES:

Adjusting for the Changing Date of Easter in Economic Series. By Jeanette Homan 328

Committee on Government Statistics and Information Services (333); Fifteenth Census Reports on Population (334); Committee on Reports and Statistics of the American Public Welfare Association (336); Inflation (338); Who Shall Inherit America? (342); Progress of the Census (345); Miscellaneous Notes (347); Members Added (357).

REVIEWS 358

PUBLISHED QUARTERLY BY THE
AMERICAN STATISTICAL ASSOCIATION
PUBLICATION OFFICE: Rumford Press, Concord, N. H.
EDITORIAL OFFICE: Columbia University, New York City

Price $1.50 per copy $6.00 per annum

NO. 183 (VOL. XXVIII) SEPTEMBER, 1933

JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION

Formerly the Quarterly Publication of the American Statistical Association

CONTENTS

THE EFFECT OF THE DEPRESSION UPON BOND YIELDS. By CARL THOMAS 261

A DISCUSSION OF THE ACCURACY OF AGRICULTURAL CENSUS ENUMERATION IN THE NORTHEAST. By I. G. DAVIS 272

THE ALLOCATION OF HIGHWAY COSTS AMONG CLASSES OF MOTOR VEHICLES FOR PURPOSES OF CALCULATING GRADUATED TAX SCHEDULES. By ARCH D. SCHULTZ 286

TESTS OF SIGNIFICANCE IN APPLYING WESTERGAARD'S METHOD OF EXPECTED CASES TO SOCIOLOGICAL DATA. By SAMUEL A. STOUFFER and CLARK TIBBITTS 293

THE AMERICAN FAMILY INCOME AND PROSPERITY. By LOUIS BADER 303

SECONDARY CURVES AS A MEASURE OF THE LAG OR PHASE DIFFERENCE BETWEEN TWO PRIMARY CURVES. By R. VON HUHN 312

NOTES:

ADJUSTING FOR THE CHANGING DATE OF EASTER IN ECONOMIC SERIES. By JEANETTE HOMAN 328

COMMITTEE ON GOVERNMENT STATISTICS AND INFORMATION SERVICES (333); FIFTEENTH CENSUS REPORTS ON POPULATION (334); COMMITTEE ON REPORTS AND STATISTICS OF THE AMERICAN PUBLIC WELFARE ASSOCIATION (336); INFLATION (338); WHO SHALL INHERIT AMERICA? (342); PROGRESS OF THE CENSUS (345); MISCELLANEOUS NOTES (347); MEMBERS ADDED (357).

REVIEWS: President's Research Committee on Social Trends: *Recent Social Trends in the United States*, by J. R. Commons (358); Fledderus (Ed.): *World Social Economic Planning*, by J. M. Clark (360); Warburton: *The Economic Results of Prohibition*, by R. S. Meriam (362); Clark: *The National Income, 1924–1931*, by S. Kuznets (363); S. H. Nerlove: *A Decade of Corporate Net Incomes, 1920 to 1929*, by R. C. Epstein (364); Wood, Struthers and Company: *Trusteeship of American Endowments*, by H. P. Willis (365); Willey and Rice: *Communication Agencies and Social Life*, by W. J. Cunningham (366); Braithwaite and Dobbs: *The Distribution of Consumable Goods*, Pitkin: *The Consumer, His Nature and Changing Habits*, by H. Kyrk (369); Cover: *Neighborhood Distribution and Consumption of Meat in Pittsburgh*, by G. Peck (370); Philip: *The Principles of Financial and Statistical Mathematics*, by Musselman (371); Tippet: *The Methods of Statistics*, by F. E. Croxton (372); Clark: *How to Budget Health*, by L. S. Reed (372); Fisher: *Statistical Methods for Research Workers*, by H. Hotelling (374); Logie (Ed.): *A Standard Classified Nomenclature of Disease*, by R. E. Chaddock (375).

Published quarterly by the American Statistical Association
RUMFORD PRESS BUILDING, CONCORD, N. H.
Editorial Office, Columbia University, New York City
Entered at the post-office, Concord, N. H., as second-class mail matter
Acceptance for mailing at the special rate of postage provided for in Section No. 1103, Act of October 3, 1917, authorized April 29, 1922

Officers of the American Statistical Association

ORGANIZED NOVEMBER 27, 1839

PRESIDENT	Stuart A. Rice	
DIRECTORS	Donald R. Belcher	Malcolm C. Rorty
	Robert E. Chaddock	Carl Snyder
	Louis I. Dublin	Edgar Sydenstricker
VICE-PRESIDENTS	Melvin T. Copeland	Arthur H. Richardson
	Frederick C. Mills	George B. Roberts
	Horatio M. Pollock	Henry Schultz
	Lowell J. Reed	William M. Steuart
SECRETARY-TREASURER	Willford I. King	
	Room 530, Commerce Building, New York University	
	236 Wooster Street, New York City	

CHAPTER AND DISTRICT SECRETARY

ALBANY CHAPTER
David M. Schneider, *New York State Department of Social Welfare, Albany, New York*

AUSTIN (TEXAS) CHAPTER
Carroll D. Simmons, *University of Texas, Austin, Texas*

BOSTON CHAPTER
Roswell F. Phelps, *Massachusetts Department of Labor and Industries, Boston, Massachusetts*

CHICAGO CHAPTER
Mrs. Bernice Lamb, *Federal Reserve Bank of Chicago, Chicago, Illinois*

CLEVELAND CHAPTER
Edward A. Stephen, *Bell Telephone Company, Cleveland, Ohio*

COLUMBUS (OHIO) CHAPTER
Howard G. Brunsman, *Bureau of Business Research, Ohio State University, Columbus, Ohio*

CONNECTICUT CHAPTER
Chester H. Whelden, Jr., *Yale University, New Haven, Connecticut*

LOS ANGELES CHAPTER
J. L. Nicely, *Room 400, Union Oil Building, Seventh and Hope Streets, Los Angeles, California*

PHILADELPHIA CHAPTER
Hiram S. Davis, *University of Pennsylvania, Philadelphia, Pennsylvania*

PITTSBURGH CHAPTER
John D. Beatty, *Carnegie Institute of Technology, Pittsburgh, Pennsylvania*

SAN FRANCISCO CHAPTER
Robert W. Bachelor, *Federal Reserve Bank, San Francisco, California*

AREA REPRESENTED AND DISTRICT SECRETARY

DETROIT AND VICINITY
John W. Scoville, *Chrysler Corporation, Detroit, Michigan*

WASHINGTON AND VICINITY
Thomas B. Rhodes, *Federal Reserve Board, Washington, D. C.*

EDITOR	Frank Alexander Ross	
	405 Fayerweather Hall, Columbia University, New York City	
REVIEW EDITOR	Leo Wolman	
	30 Fifth Avenue, New York City	
ASSOCIATE EDITORS	Edmund E. Day	Edgar Sydenstricker
	Wesley C. Mitchell	Walter F. Willcox

NO. 183 (VOL. XXVIII) SEPTEMBER, 1933

JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION

THE EFFECT OF THE DEPRESSION UPON BOND YIELDS [1]

By Carl Thomas

As an introduction to a technical analysis which will enable us to measure the effect of the depression upon bond yields, let us consider a well-known economic problem, namely, the possibility of stimulating a general bond market through action upon the short-term interest rate. As a background for this problem, let us recall Mr. Keynes' thought in this connection. He holds, if I interpret him correctly, that a reduction in the short-term interest rate would lead to a reduction in bond yields or a rise in bond prices, and consequently a rise in the value of capital goods. This would stimulate investment which would lead to the production of investment goods, which, in turn, would be accompanied by a general increase in industrial activity.[2] Without accepting this train of thought as a valid or useful general description of the genesis of industrial fluctuations, let us consider the initiating forces.

The technical problem, accordingly, is to determine (1) the extent to which changes in the short-term interest rate affect bond yields, and (2) the nature of other economic factors which may modify this effect. The first step to be taken in its solution is to identify and measure quantitatively the major elements of bond yields.

The Standard Statistics Company's Index of Yields upon 60 High

[1] This paper is a revision of an earlier presentation given at the Ninety-fourth Annual Meeting of the American Statistical Association on Friday, December 30, 1932.

[2] The following is a close paraphrase of a portion of page 154, John Maynard Keynes, *A Treatise on Money*, Vol. I, Harcourt, Brace and Company, New York, 1930.

> . . . The lower the rate of interest, the higher, other things being equal, will be the value of capital goods. If the rate of interest falls, the price level of capital goods will tend to rise, which will raise the rate of profit in the production of capital goods, which will stimulate new investment. Thus, a low rate of interest will tend to increase both the price level and volume of output of capital goods.
>
> The rate of saving, on the other hand, is discouraged by a low rate of interest.
>
> It follows that a decline in the rate of interest tends to make the rate of investment greater than the rate of saving, so that price levels, in general, tend to rise. Rising prices are accompanied by increased industrial activity. . . .

Grade Bonds,[1] hereinafter referred to as simply "Bond Yields," may be resolved analytically into the five following elements.

1. *Money Market Effect.*—This element is directly related to fluctuations in the commercial paper rate (in the New York Market) hereinafter referred to as the "Short-term Interest Rate." It appears reasonable that fluctuations in the "Short-term Interest Rate" should be reflected in "Bond Yields" in view of the fact that these fluctuations are probably proportional to changes in the general supply and demand situation in the central money market; and because the bond and commercial paper markets are integral parts of the central market—the general exchange center for cash balances and long- or short-term maturities.

2. *Secular Factor.*—This element probably represents slow changes in (a) the general level of prices, (b) the ability of the community to purchase bonds, (c) the rate at which industry and governments require bond financing, and (d) relative profitableness of bonded enterprise.

3. *Inverse Effect of Fluctuations in "Trade Volume."*—The third element of "Bond Yields" appears to be related inversely to fluctuations in a well-known physical index of industrial production, hereinafter referred to as simply "Trade Volume." It seems reasonable that fluctuations in "Trade Volume" should be inversely related to "Bond Yields," since fluctuations in industrial production contribute in a major way to fluctuations in industrial net profits, and since fluctuations in net profits are accompanied, in general, by fluctuations in the margin of safety of fixed charges. The relation which exists between this "Normal Risk" element of "Bond Yields" and industrial net profits is shown on Chart III.

4. *Direct Effect of Fluctuations in "Trade Volume."*—This element appears to be directly related to sporadic departures of "Trade Volume" from the general line of development of major movements. It is reasonable that this element should be revealed in an analysis of "Bond Yields," for it is common experience that the immediate and exceptional opportunity for profitable employment of cash balances influences bondholders to exchange cash balances for bonds (or the reverse).

5. *Residual Irregularities.*—But one significant irregularity remains after the four preceding elements have been considered. This appears to record the effect upon "Bond Yields" of the financial crisis of the past year.

These five elements, whose sum is equal to "Bond Yields," are shown

[1] This Index (Chart I) includes 15 industrial, 15 railroad, 15 public utility, and 15 municipal bonds all of which mature in 25 or more years.

CHART I

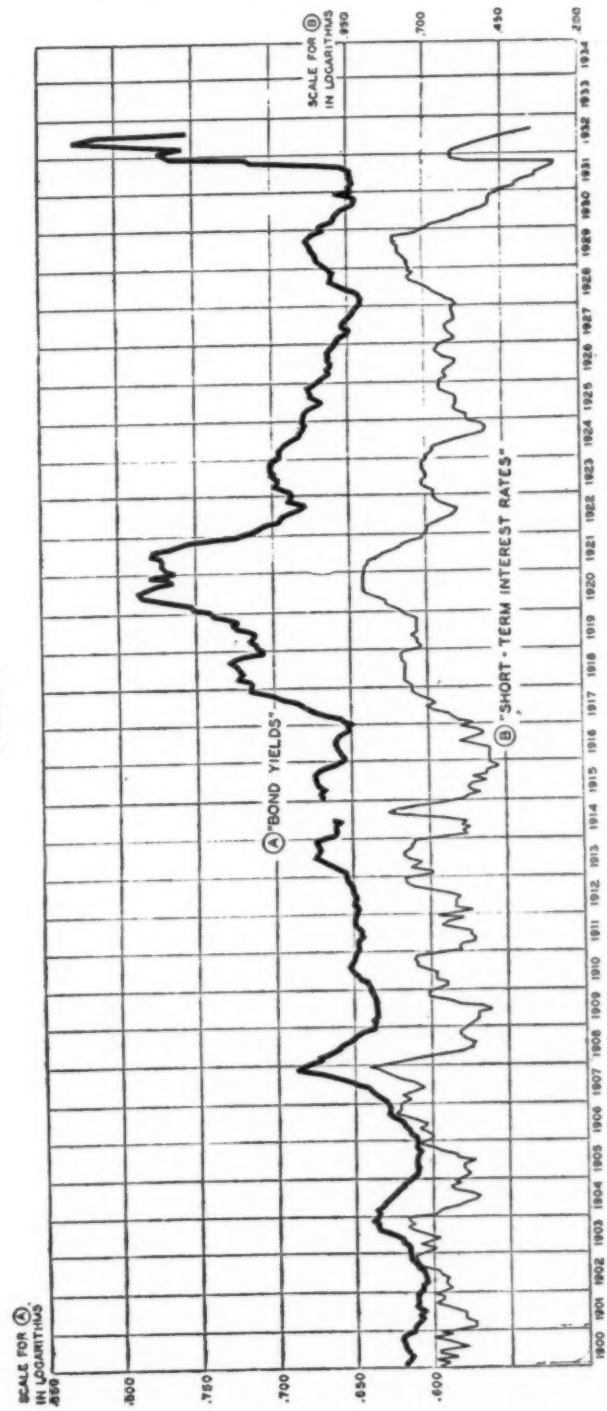

SCALE FOR (A) IN LOGARITHMS
.850
.800
.750
.700
.650
.600
SCALE FOR (B) IN LOGARITHMS
.850
.700
.450
.250
(A) "BOND YIELDS"
(B) "SHORT-TERM INTEREST RATES"
1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934

CHART II

ELEMENTS OF "BOND YIELDS"
"BOND YIELDS"
"BOND YIELDS" PER CENT
"SHORT-TERM INTEREST RATE" PER CENT
"TRADE VOLUME" PER CENT OF NORMAL
"BOND YIELDS"
① MONEY MARKET EFFECT
② SECULAR FACTOR
③ INVERSE EFFECT OF TRADE FLUCTUATIONS
④ DIRECT EFFECT OF TRADE FLUCTUATIONS
⑤ RESIDUAL IRREGULARITIES

on Chart I. Upon this Chart fluctuations of the various elements and those of "Bond Yields" are strictly comparable, since all have been expressed in the same ("Bond Yields") units.

Chart II shows in detail the progressive resolution of "Bond Yields." The detail of the relation which appears to exist between the remainder of "Bond Yields" (after elements (1) and (2) have been removed) and fluctuations of "Trade Volume," is particularly interesting. Here the simultaneous positive and negative relation between "Bond Yields" and "Trade Volume" is clearly indicated—as are the residual irregularities, more particularly the effect of the recent financial crisis.

Normally—that is, excepting (4) sporadic movements of "Trade Volume," and (5) residual irregularities—"Bond Yields" appear to be affected in a calculable way by three major factors, namely: (1) fluctuations in the "Short-term Interest Rate," (2) a secular factor, (4) fluctuations in "Trade Volume."

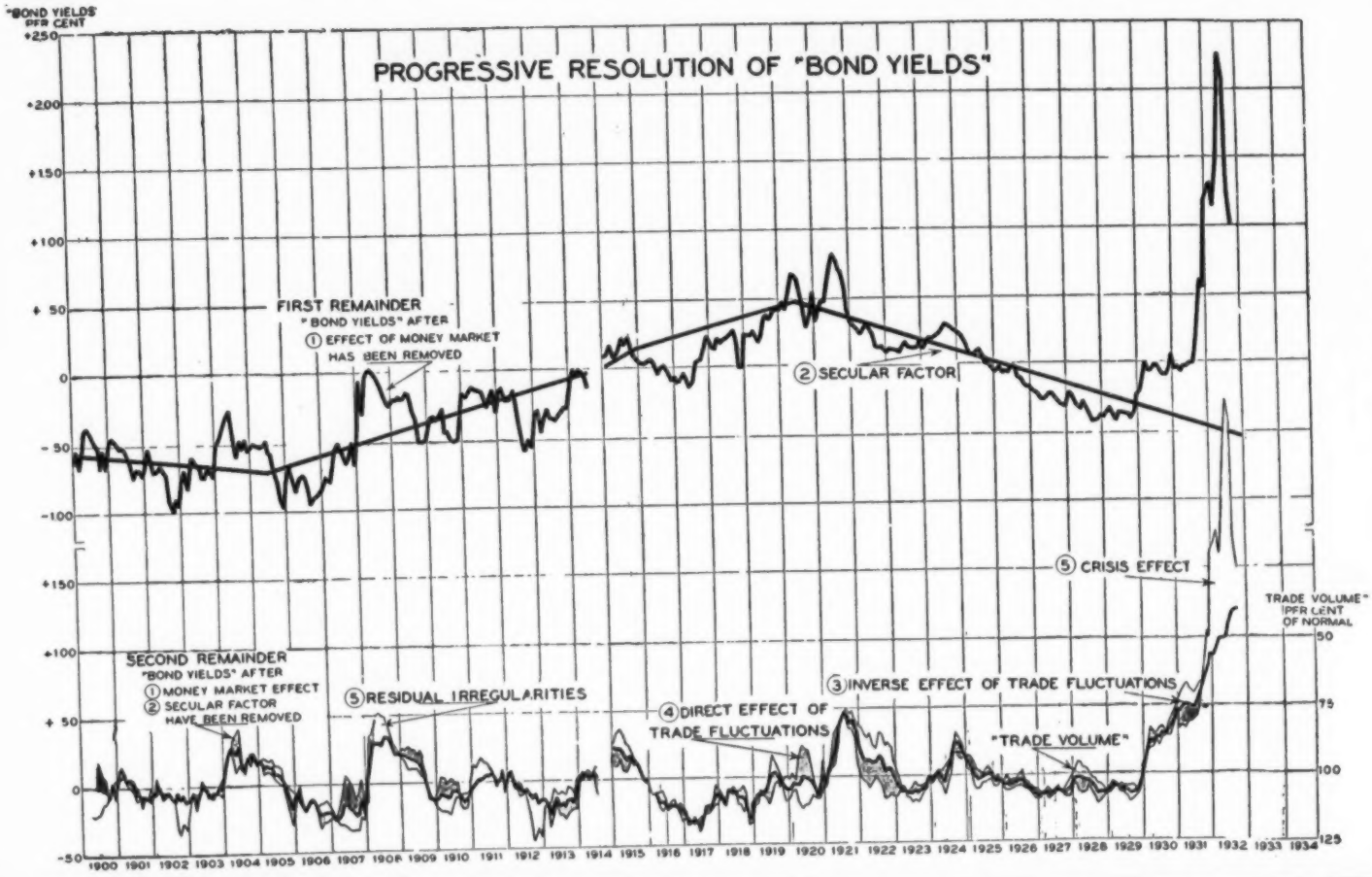
From a knowledge of the normal relations which exist between each of these three factors and "Bond Yields," it is possible to calculate their several effects upon "Bond Yields" in the past. Furthermore, by assuming particular future values of the same factors, together with continued normal relations, it is also possible to calculate future "Bond Yields" with an average historical error of approximately .05 per cent in yields.

To facilitate such calculations, nomographs embodying these normal relations have been prepared (Chart IV) and an example of their use provided at the end of this article.

In the past, the effects upon "Bond Yields" of (1) fluctuations in the "Short-term Interest Rate" (money market effect) and (4) fluctuations of "Trade Volume," appear to have been of roughly equal importance. Each contributed as much as .60 per cent to "Bond Yields" in periods of maximum fluctuation, for example, during the years 1902–09, when "Bond Yields" varied between 4.00 and 4.80 per cent. During war years, however, war and Government activities pressed upon the money market to a much greater degree than "Trade Volume" responded to war orders. The effect of the money market upon "Bond Yields" was, accordingly, relatively greater than that of "Trade Volume." During these years, the effect of the money market probably exceeded .95 per cent.

The depression from 1929 levels involved an unprecedented negative fluctuation of "Trade Volume" and a major decline in the "Short-term Interest Rate." The former contributed an increase in "Bond Yields" of approximately 1.50 per cent and the latter a decrease of roughly .75

CHART III


PROGRESSIVE RESOLUTION OF "BOND YIELDS"
"BOND YIELDS" PER CENT
+250
+200
+150
+100
+ 50
0
- 50
-100
FIRST REMAINDER
"BOND YIELDS" AFTER
① EFFECT OF MONEY MARKET
HAS BEEN REMOVED
② SECULAR FACTOR
⑤ CRISIS EFFECT
"TRADE VOLUME" PER CENT OF NORMAL
150
100
50
SECOND REMAINDER
"BOND YIELDS" AFTER
① MONEY MARKET EFFECT
② SECULAR FACTOR
HAVE BEEN REMOVED
⑤ RESIDUAL IRREGULARITIES
③ INVERSE EFFECT OF TRADE FLUCTUATIONS
④ DIRECT EFFECT OF TRADE FLUCTUATIONS
"TRADE VOLUME"
75
100
125
1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934

per cent. Beginning in September, 1931, the financial crisis appeared and, in May of 1932, contributed a further increase of approximately 1.70 per cent. At the present time, however, the crisis effect has declined markedly and now amounts roughly to .60 per cent. The net effect of these three factors was an increase in "Bond Yields" of approximately 1.35 per cent. This is a fair estimate of the net effect of the depression upon "Bond Yields." It may be observed that the decline in "Trade Volume" (roughly twice as great as any previously recorded) contributes the major portion of the depression effect.

The nomographs of Chart IV, which condense the quantitative findings of the previous statistical analysis, provide the material necessary for the solution of our immediate problem which, it will be recalled, concerns the effect of changes in the "Short-term Interest Rate" upon "Bond Yields" as a means of stimulating the market for high grade bonds.

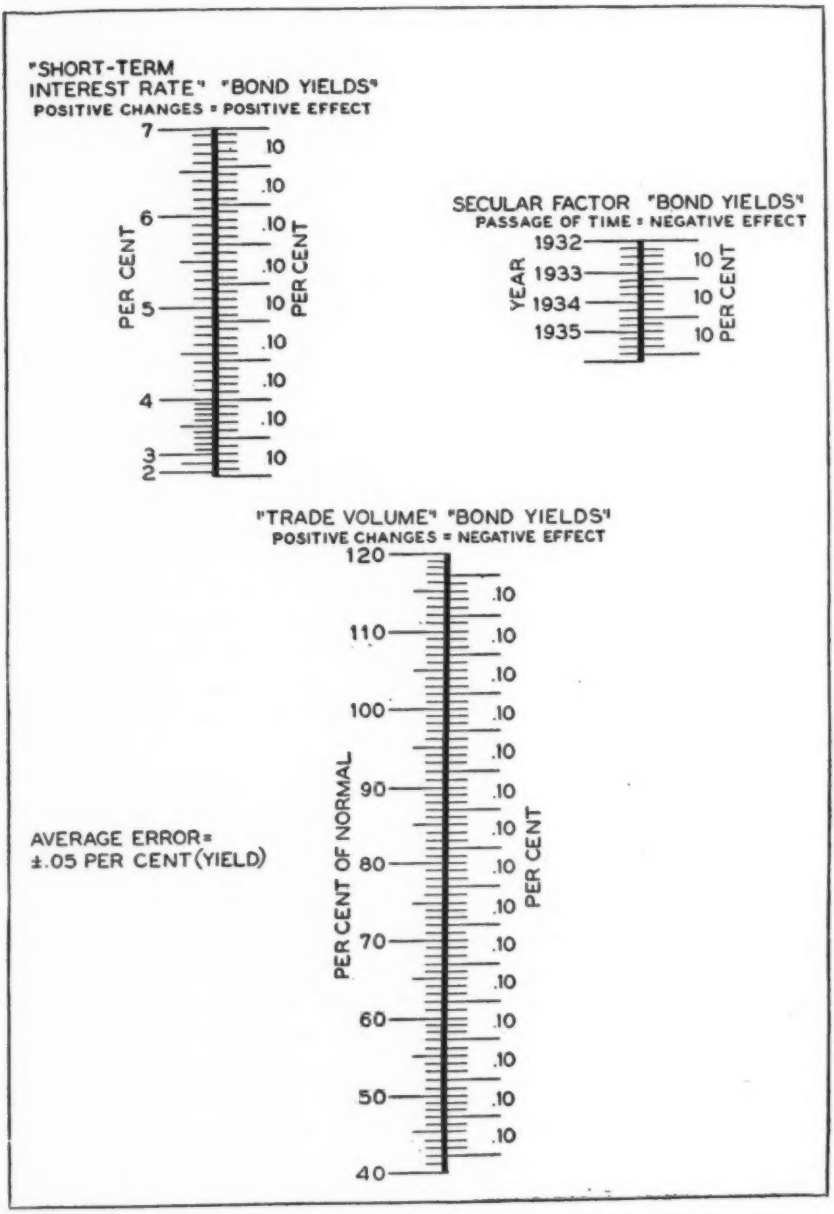
It may first be noted that the effect of changes in the "Short-term Interest Rate," when the latter lies between 2 and 3 per cent, is much less than when it lies between 5 and 6. Changes at or near a 75 year average rate of 4.95 per cent would, therefore, be more effective than the same changes at a lower level. It may also be noted that the inverse effect of "Trade Volume" upon "Bond Yields" is proportional throughout the entire range of the data. These observations lead to a separate consideration of two major aspects of our problem: first, when "Trade Volume" and the "Short-term Interest Rate" are both at or near their respective "normals," and second, when both are subnormal, as at present.

The first is the traditional "normal" situation, properly the starting point of theoretical discussions such as that of Mr. Keynes. In this case, other factors aside, it is clear from the nomographs that a decrease of 1 per cent in the "Short-term Interest Rate" would result in a decline of approximately .24 per cent in "Bond Yields." The high grade bond market would thus, normally, be stimulated to this extent, providing "Trade Volume" and the secular factor remained unchanged. It may be observed, however, that historically, both of these conditions are improbable. For our immediate purpose, therefore, it is desirable to note that it would require a decline in "Trade Volume" (industrial activity) of only 12 per cent to offset a 1 per cent decline in the "Short-term Interest Rate" and consequently to neutralize its effect as a stimulant. Thus, even at or near "normal" economic conditions, the net effect of lower interest rates in the central money market would depend largely upon current movements of

CHART IV

NOMOGRAPHS

SHOWING EFFECTS OF CHANGES IN THREE MAJOR FACTORS UPON BOND YIELDS



AN EXAMPLE OF THE USE OF THE NOMOGRAPHS SHOWN ON CHART IV

Assume:

(a) "Bond Yields" as of October, 1932 ..... 5.25 per cent
(b) Return of the "Short-term Interest Rate" to 4.95 (75 year average) ..... January, 1935
(c) Continuation of present secular decline in "Bond Yields" ... January, 1935
(d) Return of "Trade Volume" to 100 ..... January, 1935
(e) Complete disappearance of the financial crisis.

To Find:

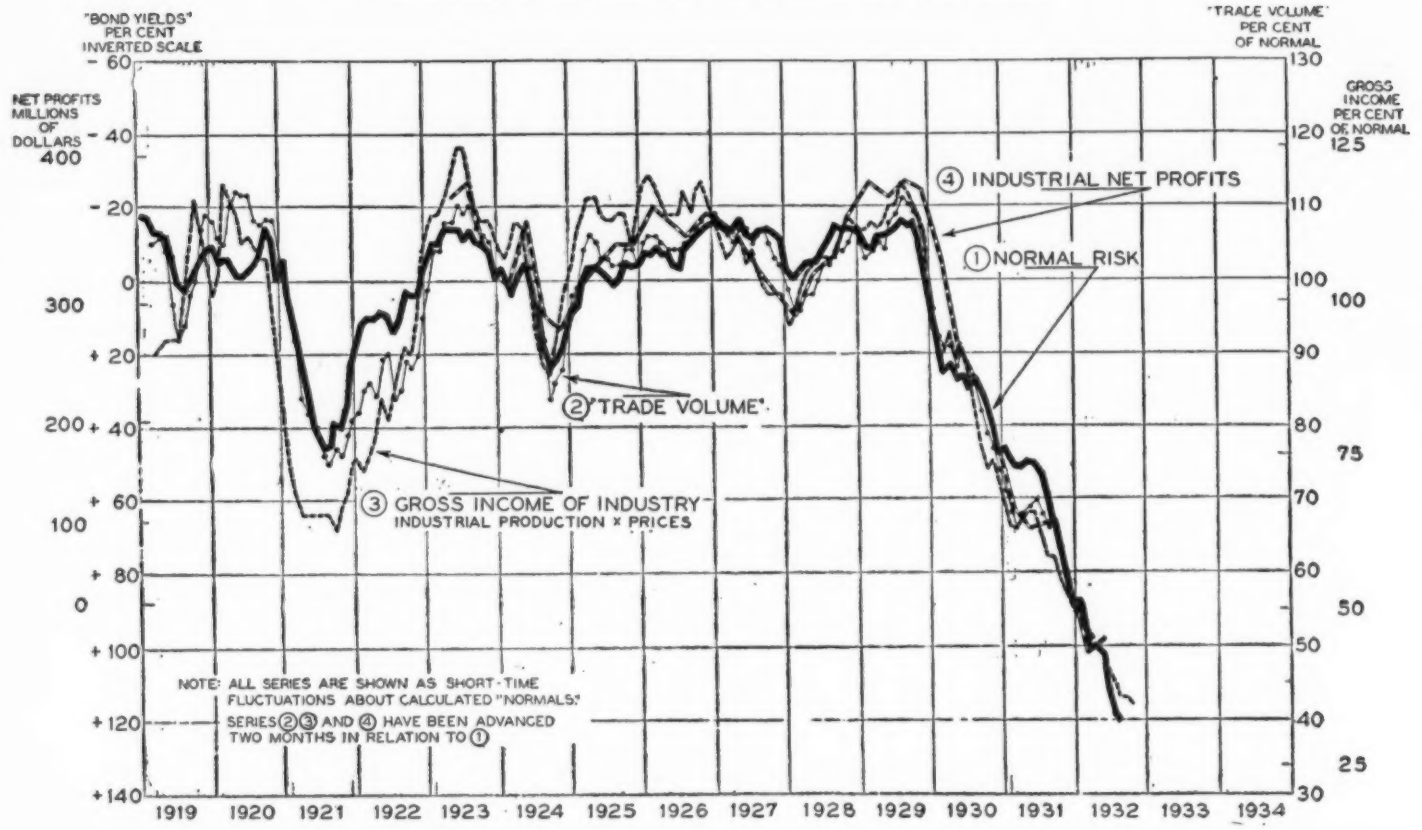
(a) "Bond Yields" as of January, 1935.

The Calculation:

	Change in	*From*	*To*		*Effect Upon "Bond Yields"*	
(b)	"Short-term Interest Rate"	2.00	4.95	Read, on nomographs, the effect upon "Bond Yields" of given changes in factors b, c, d	+ .40	per cent
(c)	Passage of time	October, 1932	January, 1935		− .25	
(d)	"Trade Volume"	−40	100		−1.20	
(e)	Passing of the financial crisis				− .60	
				Net Change	−1.65	.... (1)
	Average error (historical)				± .05	
				"Bond Yields" as of October, 1932	5.25	.... (2)
(2) − (1)				"Bond Yields" as of January, 1935	3.60	± .05

CHART V

SIGNIFICANCE OF THE NORMAL RISK ELEMENT OF BOND YIELDS


"BOND YIELDS" PER CENT INVERTED SCALE
"TRADE VOLUME" PER CENT OF NORMAL
NET PROFITS MILLIONS OF DOLLARS
GROSS INCOME PER CENT OF NORMAL
④ INDUSTRIAL NET PROFITS
① NORMAL RISK
② "TRADE VOLUME"
③ GROSS INCOME OF INDUSTRY
INDUSTRIAL PRODUCTION × PRICES
NOTE: ALL SERIES ARE SHOWN AS SHORT-TIME FLUCTUATIONS ABOUT CALCULATED "NORMALS."
SERIES ②③ AND ④ HAVE BEEN ADVANCED TWO MONTHS IN RELATION TO ①
1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934

"Trade Volume." In other words, the element of "Bond Yields," which appears to be inversely proportional to changes in "Trade Volume," could be expected at all times to augment or offset effects of changes in the "Short-term Interest Rate." Mr. Keynes' argument, therefore, is incomplete. For its completion, it is necessary to consider, in addition, the effect of the fluctuations in "Trade Volume" upon "Bond Yields"—even when the argument is applied to the "normal" situation.

The second case is where both "Trade Volume" and the "Short-term Interest Rate" are depressed, as at present. This is virtually a test case for the theory of stimulation of the bond market through changes in the "Short-term Interest Rate," for it is during depression periods that such procedure would be of the greatest practical value.

Referring once more to the nomographs of Chart IV, it is clear that with the "Short-term Interest Rate" at or near 3 per cent, a further decline of 1 per cent would have practically no effect upon "Bond Yields."

It would, accordingly, prove disappointing to look for stimulation of the bond market from this source alone, when, as at the present time, the "Short-term Interest Rate" is even lower. On the other hand, the present level of "Bond Yields," being affected proportionally by the extraordinary decline of "Trade Volume," is high, because of this factor alone, to the extent of approximately 1.20 per cent, an impressive figure.

Thus, during a major depression, it is clear that the level of "Bond Yields" depends, in the main, upon the course of "Trade Volume." Because of this, it appears that the effectiveness of changes in the "Short-term Interest Rate" would be negligible, in terms of Mr. Keynes' theory, at precisely the time when they could be of the greatest service.

From the foregoing analysis, it appears that, from a practical standpoint, the popular theory of stimulating the bond market by depressing the "Short-term Interest Rate" requires modification to the extent that the effect of fluctuations in "Trade Volume" upon "Bond Yields" needs to be considered. It is necessary at present, above all times, to consider this effect.

At the present time, the high levels of "Bond Yields" appear in the main to be the result of the current trade depression, and to be practically independent of the current supply and demand situation in the central money market.

It follows that the course of "Bond Yields" in the immediate future will depend largely upon the future course of "Trade Volume."

A DISCUSSION OF THE ACCURACY OF AGRICULTURAL CENSUS ENUMERATION IN THE NORTHEAST

By I. G. Davis, *Connecticut State College*

The reports of the United States Census of 1930, particularly as they apply to townships and other minor civil divisions, and in respect also to certain important state and county totals, have been regarded as unreliable in a number of important areas in the United States. On the other hand, in many important agricultural regions the 1930 Census is regarded as satisfactory. Reports received from departments of agricultural economics in the several land grant colleges would indicate that there is a belief that serious inaccuracies exist in all areas affected with part-time farming, and in other important areas where special conditions prevail. Such areas would include the frontier areas, the semi-arid regions, the cropper-tenant sections of the Cotton Belt, self-sufficing areas, and a considerable number of other areas where the methods of the Census failed to prove sufficiently adaptable to conditions to yield dependable results.

The purposes of this paper are to examine the reliability of Census results under one set of special conditions where the Census is deemed to have gone astray, namely, in part-time farming areas, and to discuss certain proposals for improving Census methods in these areas. Much of the paper will be devoted to a specific area, the Eastern Connecticut Highland, and certain very general conclusions will be projected from the facts of this particular area.

Grounds for suspicion as to the accuracy of the Census in Connecticut arise from a number of sources. The 1930 Census reports a decrease of about twenty-six per cent in the number of farms in the state. Since the definition of a farm used by the Census in form, at least, remained unchanged, and since the number of places falling within the scope of this definition is generally regarded as not having actually declined, the Census result reporting such a falling off immediately raises a question of accuracy. This fact as to the amount of change naturally leads one who is interested in the question of the localization of change and the direction of local or township trends to ask the question: "Where did these changes occur? Were they characteristic of certain areas, soil types or locations with relation to the centers of population?" The answer is negative. Adjoining townships throughout the state existing under conditions of marked likeness as to soil, topography, relation to population centers and economic institutions

exhibit extremely marked variations in the direction of change, as shown by the Census, from 1920 to 1930. Chart I shows the per cent change in the number of farms in Eastern Connecticut by townships. No further comment is necessary than to ask the reader to study the map carefully and observe the numerous cases where these marked variations occur.

Means were sought to find some generalized expression of the extent of these variations. For any two towns it was assumed that the algebraic difference in the per cent of change occurring over a given interval of time would constitute a good measure of the variation in change. For example, if in town A the number of farms had increased 25 per cent and if in town B, adjoining, the number had decreased 25 per cent, the algebraic difference would be 50. These differences would constitute a rough index of difference in the rates of change between towns. There are a number of cases where the difference in rates of change between adjoining towns exceeds 100 and a larger number of cases where it exceeds 50. It is not logical to expect the existence of these marked discrepancies in the direction of trends in adjoining towns where conditions are fairly similar, and it is entirely contrary to the experience and observation of those who live in the territory and are familiar with events of the past seven years. It would seem, therefore, that these discrepancies must have been the result of some inconsistencies in enumeration.

It was decided to formulate a method of summarizing the degrees of difference appearing between adjoining towns.

The method employed was to compare the percentage change in each town with the weighted average percentage change in all adjoining towns within a given area deemed to be fairly homogeneous with respect to the operation of forces causing change. For example, suppose in township C the number of farms had increased 25 per cent and the weighted average percentage change in all adjoining towns was a 25 per cent decrease. The figure used would again be +50 for the given town. Frequency distributions were constructed and standard deviations computed for the series thus derived.

We may now discuss the significance of such frequency distributions. Superficially they are a picture of the differences in the rates of change in the number of farms reported by the Census in a series of given towns as compared with all towns adjoining each given town. The frequency distribution summarizes the situation for an area.

If Census enumeration and tabulation are complete, accurate, and the same definitions of terms in the schedule applied with perfect consistency among towns and between periods of enumeration, then the

CHART I

PERCENTAGE CHANGE IN NUMBER OF FARMS IN EASTERN CONNECTICUT HIGHLAND

Upper figure, 1920–25. Middle figure, 1925–30. Lower figure, 1920–30.

results must reflect the changes which actually occurred. If, on the other hand, there exists complete homogeneity with relation to the operation of the forces causing change in the number of Census farms, places occupied by a family, and having over three acres of land or producing over $250 of product, then the differences appearing must be almost entirely the result of inconsistency in definition, faulty enumeration, or both. Since neither complete consistency and accuracy of enumeration or complete homogeneity prevails, the differences in rates of change observed are probably ascribable to both causes. In any particular case it becomes a question of determining in some degree the weight to be attached to each set of causes. The method described above was applied to the data for the townships of the Eastern Connecticut Highland. The frequency distribution of the extent which the percentage change of each township was in excess or deficit of the average percentage change of all its adjoining townships is shown in Chart II.

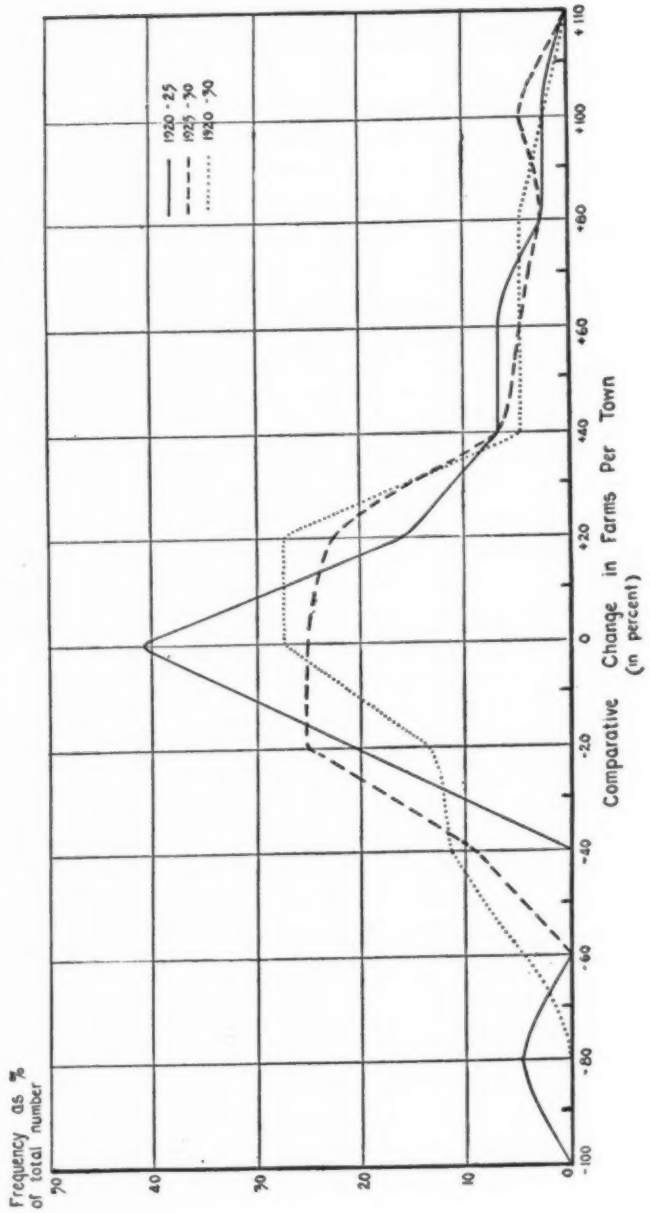
The Eastern Connecticut Highland is almost entirely upland in character, interspersed with numerous narrow valleys. Soils are diverse but so scattered that most of the soils can be found in any one town. There are no large cities. The small cities are quite evenly scattered throughout the area and between are the numerous small industrial villages occurring in practically every township. The area is one that appears to be quite homogeneous with respect to the operations of any forces that might cause change in the number of farms being reported under the terms of the Census definition. It is, furthermore, a matter of common and general observation that the farm houses on farms reported in the 1925 Census were still there in 1930, and that agricultural operations were being conducted on them—often on a part-time basis—but not so reduced as to disqualify the farms for classification as Census farms.

After the frequency distributions plotted in Chart II had been examined, the mean and the standard deviation of each series were computed. The standard deviation of the series based on the 1920–25 Census was 33.6; of the series based on the 1925–30 Census, 33.9; and of the series based on the 1920–30 Census, 35.0. It should be noted that in all three distributions, particularly the one representing the changes between 1925 and 1930, there are a number of cases of towns which show a very wide difference in the direction and amount of change as compared with adjoining towns. In most instances these towns are in territories where soil type and the character and density of population are similar.

A means was sought of determining whether the changes in the num-

CHART II

FREQUENCY DISTRIBUTION OF PER CENT CHANGE IN NUMBER OF FARMS IN EACH TOWN IN EASTERN HIGHLAND AS COMPARED WITH PER CENT CHANGE IN ADJOINING TOWNS



bers of farms in townships were relatively more unstable, and more subject to haphazard change due to errors or bias in enumeration than were the changes in the number of farms in larger units such as a county. Within the county, the errors, failures to enumerate, and personal bias of each of a number of enumerators would have a tendency to cancel each other. It was decided, therefore, to take the counties of Southern New England and treat them in the same manner as the townships of the Eastern Connecticut Highland had been treated. The area of Southern New England taken as a whole is less homogeneous than the Eastern Connecticut Highland. It contains counties that are highly agricultural like Litchfield County, Connecticut, Franklin County, Massachusetts, and Washington County, Rhode Island. It contains a number of counties where industry and commerce are highly developed. It contains upland and valley counties.[1] As compared with the Eastern Connecticut Highland, the area is diversified and considerable variations in the amount and direction of change between a county and adjoining counties might well be expected. Frequency distributions, however, of the deviations of the change in each county from the changes in adjoining counties computed in a similar way to the data used in Chart II exhibit much less dispersion than the series there shown. The standard deviations of these distributions are 15.27 for 1920–25, 16.31 for 1925–30, and 15.52 for 1920–30. It appears that the dispersion of this series is less than half of that exhibited in the case of the Eastern Connecticut Highland. We conclude, therefore, that there is strong evidence in the comparison of these two distributions and their dispersions, that the numbers of farms reported in townships are erratic, and that they cannot be depended on to be comparable either with adjoining towns or other periods of enumeration. This is no evidence of the accuracy of county totals, which, as will be shown later, tend to have a downward bias.

While the results thus far reported in this paper make it seem probable that marked inconsistencies exist in the results of tabulated Census enumeration, they throw no light on the causes of these inconsistencies nor do they positively show whether the inconsistencies exist. They do, however, create a very strong presumption that such is the case. To confirm this presumption it is necessary to use some unbiased body or bodies of data with which to check the results of the Census tabulation.

Two such bodies of data were found to be available for the Eastern Connecticut Highland. The first is the schedule of a type of farming

[1] Suffolk County, Massachusetts, in which Boston is located, and Dukes and Nantucket, two island counties, were omitted.

survey that had been made in twelve townships in the Eastern Connecticut Highland by the Connecticut State College coöperating with the United States Department of Agriculture, soon after the Census enumeration. Schedules were obtained in one township in the summer of 1930 and the work was completed in May, 1931. The enumerators in the survey were instructed to visit every house or residence outside of the compact villages, and if such proved to be a farm within the scope of the Census definition—that is, if it possessed three acres or more of land—they were instructed to secure a record on this place. The record included the number of acres of different kinds of crops, the number of different kinds of livestock, and other items. These townships were located in the open country—that is, they did not contain large boroughs or large manufacturing villages—and there was in these towns little of that kind of part-time farming which may be classified as suburban part-time farming. Of the farms found by this survey, while over 99 per cent had qualified in respect to acreages according to the Census definition, 523 were classified as residence farms, 613 as commercial part-time farms, 401 as specialized dairy farms, 81 as dairy-poultry farms, and the remaining 509 were of miscellaneous full-time agricultural types. Table I shows the comparison of the 1930 Census with the result of the type of farming survey in twelve towns in the Eastern Connecticut Highland.

It will be observed from this table that there are two townships in which the number of farms reported by the Census is 22 per cent less than the number found by the survey, and that there is one town in which the number found by the Census is 49 per cent less than the number found by the survey. For the twelve towns as a whole, the Census found 10 per cent less acres, 10 per cent fewer cows, and 15 per cent fewer head of young stock than in the survey.

While there is but one township in the twelve township sample in which the rate of change varies more than 40 per cent from the rate of change in adjoining towns, there are in the Eastern Connecticut Highland as a whole eleven townships out of forty-five which vary more than 40 per cent in the rate of change in the adjoining towns. It is probable that the deviation of the Census and the results of our survey in the twelve sample towns is not so great by a considerable amount as it would have been in the area as a whole if a similar survey had been made in the entire area. The results of the twelve sample towns, in other words, made out a better case for the Census from the standpoint of consistency than is actually justified.

A further interesting comparison is that between the per cent of deviation in number of farms of the 1930 Census from the survey, and

TABLE I

COMPARISON OF CENSUS WITH A TYPE OF FARMING SURVEY ON TWELVE TOWNS IN THE EASTERN H IGHLAND AREA

Town	Number of farms			Acres in farms			Number of cows			Total number kept for present and future dairy			Acres silage		
	Survey	1930 Census	Per cent deviation, Census from survey	Survey	1930 Census	Per cent deviation, Census from survey	Survey	1930 Census	Per cent deviation, Census from survey	Survey	1930 Census	Per cent deviation, Census from survey	Survey	1930 Census	Per cent deviation, Census from survey
Ashford	129	131	+ 2	18,036	16,665	− 8	509	428	−16	842	735	−13	73	43	−41
Brooklyn	109	121	+11	11,344	12,594	+ 1	583	623	+ 7	898	884	− 2	136	117	−14
Canterbury	222	173	−22	20,513	18,536	− 9	840	809	− 4	1,353	1,216	−10	166	116	−30
Columbia	130	128	− 2	11,031	9,980	−10	619	553	−11	922	782	−16	113	89	−21
Coventry	240	178	−26	17,993	14,681	−18	973	978	0	1,608	1,373	−15	245	200	−19
E. Haddam	245	223	− 9	20,604	21,354	+ 4	867	843	− 3	1,343	1,229	− 8	139	116	−17
Griswold	161	130	−19	19,024	14,308	−25	736	518	−30	1,207	804	−33	186	112	−40
Marlboro	67	52	−22	12,188	7,784	−36	367	339	− 8	563	500	−11	65	57	−12
N. Stonington	201	179	−11	25,099	22,826	− 9	923	861	− 7	1,535	1,277	−17	212	220	+ 3
Stonington	156	149	− 4	16,413	13,587	−17	884	690	−22	1,414	1,259	−11	201	206	+ 2
Waterford	181	92	−49	12,110	7,981	−34	1,036	748	−23	1,539	1,059	−31	250	130	−48
Woodstock	289	288	0	17,712	21,589	+22	1,475	1,487	+ 1	2,380	2,210	− 8	289	285	− 1
Total	2,130	1,844	−13	202,067	181,885	−10	9,812	8,877	−10	15,604	13,328	−15	2,075	1,691	−19

the deviation of the 1930 Census from the 1925 Census. The results of such comparison are shown in Table II.

TABLE II

PER CENT DEVIATION IN NUMBER OF FARMS OF THE 1930 CENSUS FROM THE SURVEY AND THE 1925 CENSUS

Town	Per cent change from 1925 to 1930 Census	Per cent deviation 1930 Census from survey
Ashford	+27	+ 2
Brooklyn	+14	+11
Woodstock	+ 2	0
Stonington	− 1	− 4
Columbia	− 6	− 2
E. Haddam	− 8	− 9
Canterbury	− 9	−22
N. Stonington	−18	−11
Marlboro	−21	−22
Griswold	−23	−19
Coventry	−26	−26
Waterford	−49	−49

It is apparent from the above that the towns which showed a marked decrease in the number of farms between 1925 and 1930 were in every case the towns in which the survey revealed a significantly greater number of farms than the Census. The conclusion is obvious. These farms had not disappeared. The Census failed to enumerate them.

The results presented thus far make it evident that one of two things must have happened. Either the enumerators in some towns were much more efficient and painstaking in their work than in others, or there must have existed a different conception on the part of enumerators of the definition of a farm. Lack of standardized definition might have very easily given rise to all the inconsistencies discovered, particularly in an area where so many borderline cases exist as is the case in part-time farming areas. A careful examination of the instructions issued to enumerators, both with relation to the agricultural Census and the population Census, indicates that the effect of the entire body of instructions was such as would be likely to lead to confusion on the part of enumerators as to the definition of a farm and to a lack of standardization of the definition among enumerators in the area as a whole.

This leads to the conclusion that in the Eastern Connecticut Highland, and probably throughout Connecticut, township data are unreliable largely because of incomplete enumeration. The primary cause of this is the unstandardized and subjective interpretation on the part of the enumerators of the definition of a farm and the instructions relating to the cases in which farm records should be obtained. The bias is almost always downward and affects the item "number of farms" most significantly, but it also throws into error all other items in the schedule by varying amounts.

An effort was made in one case to substantiate the belief that the definition of a farm used by the enumerators was subjective and varied greatly from town to town. Two adjoining towns were selected, Ashford, in which according to the Census the number of farms increased from 103 to 131, or 27 per cent during the 1925–30 interval, and Mansfield where the number of farms was reported by the Census as decreasing from 238 to 79, a decrease of 66 per cent. The writer has maintained his residence for the past seventeen years near the boundary line between these two towns and has been in close contact with the entire area. Since he had failed to observe any significant differences in the directions of change of the two areas during this period, the Census returns were surprising. A rough check was devised using tax assessors' returns. Since each tax payer is required to make and swear to such returns annually and subject to penalty for failure, considerable reliance may be placed in returns on important tangible items. An effort was made, therefore, to determine the notion or definition of a farm in the mind of the Census enumerator by checking his performance with the tax returns for the same year.

It was assumed that the enumerator in either town may have had in mind one of three definitions of a farm. Under the "A" definition he would think of a farm as any place occupied by a family and having three or more acres of land, a dwelling and a barn. Under the "B" definition, he would think of a farm as having the above land and buildings and a cow or cows or poultry or both. Under the "C" definition he would think of a farm as having a minimum business represented by the equivalent of at least three cows. The enumerators may have had any one of these definitions in mind or some intermediary definition.

TABLE III
ASHFORD

Census year	Number of farms				Number of acres			
	A	B	C	Census	A	B	C	Census
1925	173	111	81	103	19,570	13,353	10,976	14,134
1930	169	107	85	131	18,003	12,268	10,416	16,665

TABLE IV
MANSFIELD

Census year	Number of farms				Number of acres			
	A	B	C	Census	A	B	C	Census
1925	334	218	124	238	18,028	15,471	12,133	21,638
1930	327	175	104	79	20,856	13,334	10,065	9,366

It is apparent from Tables III and IV that in the town of Ashford the enumerators between 1925 and 1930 shifted from a definition between the B and C position to one between the A and B definition.

In the town of Mansfield, however, the enumerators during the same half decade shifted from a point midway between the A and B definition to one significantly below the C, approximately a D definition if one had been set up. Thus we have here two adjoining towns in which the Census returns exhibited marked divergence in the direction of change, and in which the change is actually largely in the shifting viewpoints of enumerators as to what constituted a Census farm.

The total amount of error appearing as the result of the defects of enumeration may be considered from the point of view of either one of two standards. It may be considered either from the standpoint of comparison with complete enumeration, assuming an adherence to the minimum definition of a farm set forth in the Census, or, second, from comparison with the standards of performance in the 1925 and the 1920 Census. With relation to the first standard we have no basis of judgment. Dr. David Rozman estimates that approximately one-half of the 33,000 farms found in the 1925 Census in Massachusetts were part-time farms, and that there were about 25,000 to 30,000 more which the agricultural Census did not find.[1] He estimated the annual value of the agricultural products of these farms as about $17,000,000 in 1929. Rozman's findings would at first thought lead us to believe that the 1925 and the 1920 Census omitted many part-time farms. There is no way of knowing, however, just what proportion of the part-time farms not enumerated by the Census but estimated or found by Rozman would qualify as farms under the Census definition. In comparison with the 1925 and the 1920 Census, however, we know that the 1930 county and state totals are in deficit by an unknown amount, probably in excess of 15 per cent of the number of farms and 10 to 15 per cent in respect to many of the other items as compared with the 1925 Census.

For the eight counties of the state, decreases appear in the number of farms reported in the 1930 Census as compared with the 1925 Census ranging from 18 to 39 per cent. For the three eastern counties of the state taken as a unit, the average decrease is 18 per cent. These three counties constitute the Eastern Connecticut Highland. The twelve sample townships which were used for check purposes show a decrease of 11 per cent in the Census returns. The 1930 check survey reveals

[1] See *Proceedings of International Conference of Agricultural Economists*, Ithaca, New York, 1930, p. 281.

the presence of more farms than were found in the 1925 Census. Since it has already been pointed out that this sample contained fewer towns showing marked decline than appeared in the area as a whole, there is reason to believe that the decline in the number of farms reported in the Census for these three counties did not actually occur, but that the lower figures are largely the result of faulty enumeration. The other five counties are in more highly industrialized and commercialized sections where suburban developments have proceeded more rapidly than in the three eastern counties. There has undoubtedly been in these five other counties both an increase in part-time farming and some movement of land out of farms into urban uses or summer residences. In view of the deficiencies of enumeration in the Eastern Connecticut Highland, it seems reasonable to believe that similar deficiencies occurred in the other five counties of the state. To persons thoroughly acquainted with conditions in these counties, it appears probable that there has been little if any decline in the number of farms that would qualify under the terms of the Census definition. The reported number of farms, therefore, is probably in error by an amount somewhere between 15 and 25 per cent.

Because of the fact that the farms omitted were in most cases part-time farms, these errors in enumeration do not have proportionately as important an effect on the reported number of cattle and acres of crops as they do on the number of farms. Nevertheless they create a sufficient degree of error to make comparisons between state totals and county totals for 1925 and 1930, or for 1930 and any previous Census of little value. If we had positive knowledge of the extent of the error appearing in any total, it would be possible to make corrections. Such evidence, however, is lacking.

TABLE V

SHOWING TOTALS AND AVERAGE FIGURE PER FARM ON CERTAIN ITEMS IN CONNECTICUT, 1925 AND 1930[1]

	1925	1930
Total number farms	23,240	17,195
Total acres	1,832,110	1,502,279
Average size of farm (acres)	78.8	87.4
Total number cows	112,623	94,028
Average number milk cows per farm	4.85	5.47
Total number chickens	1,698,900	1,536,725
Average number chickens per farm	70.5	89.3
Crop land harvested (acres)	497,435	372,147
Average crop land per farm	21.4	21.6

[1] From the Fifteenth Census of the United States, 1930. Agriculture, Vol. II, pp. 224–226.

Table V shows the total and average number of acres, cows, chickens, and crop land harvested for Connecticut in 1925 and 1930. It will be

observed that the totals have in every case declined during the 1925–30 interval, in some cases significantly, and that the average size of farm has increased. If we have in mind the Census farm defined according to a standardized definition over the two Census periods, we are left in a state of doubt as to what has actually occurred.

Since the Census totals are an important basis for the projection of crop and livestock estimates by the Federal Service and are used by numerous agencies in the formulation of policy, a fair degree of accuracy is necessary. When used for purposes of comparison with 1925, the 1930 state totals are probably sufficiently in error so that no creditable conclusions can be drawn regarding the trends of agriculture during this interval.

Let us now consider for a moment the extent to which the conclusions appearing for Connecticut are applicable to the northeastern United States. The number of farms reported in each of the northeastern states fell off significantly from 1925 to 1930. The range of decline was from about 14 per cent in New Jersey and Pennsylvania to 29 per cent in New Hampshire. These figures are strikingly similar to the changes in counties in Southern New England. There seems little reason to doubt that the same lack of standardization in the definition of a farm operated throughout the part-time farming area of the northeast introduced a considerable but unknown amount of error into all Census totals. It also rendered comparisons among minor civil divisions for the 1930 period, and between state, county and regional totals for the 1925 to 1930 period, of very dubious validity.

This paper is presented in no wise as a general indictment of the Census. The tremendous difficulties facing the Census Bureau and the success with which it has attacked many phases of its great task are appreciated.

The great variations which occur in the character of the farm over the area of the United States, the range of type of farming from part-time farming near cities to the ranches of Texas and the West, and the diversity of conditions of tenure, make it difficult to set up one general definition of a farm and one general set of instructions covering that definition which will be interpreted unambiguously by inexperienced enumerators throughout the United States. The inconsistency resulting from subjective definition of a farm is an excellent example of uniformity of instructions producing erratic results and breaking the continuity of series because of the diversities appearing in the area of enumeration. In the part-time farming areas the inconsistency among enumerators in their definition of a farm has given rise to errors in totals of all the items appearing in the schedules. This experience raises the

important question of how such difficulties may be avoided in the future. While the solution of the problem lies with the Census Bureau, the question may be asked as to whether the solution may not lie in part along the following lines:

1. Enumerators might be instructed to secure schedules on all possible cases both from farms and part-time farms and classification be made in the central office rather than being left to the judgment of the enumerator in the field.

2. Special supplementary instructions might be prepared for each part of the United States where important inconsistencies have appeared in the past and an effort made to give personal instruction to enumerators in groups or singly.

3. Census enumerators might be appointed on a basis of merit, rather than of political preferment.

4. Special advisers thoroughly familiar with conditions in various parts of the United States might be asked to help in adopting schedules, instructions and training of enumerators.

The accuracy of the Census results, the preservation of the continuity of Census series, and the comparability of results over time and between areas are all matters of great importance. Accuracy and comparability are not only important with relation to national and state results, but with relation to the results in counties and minor civil divisions. The agricultural Census is our fundamental body of basic data as to inputs and outputs, as to farm and social organization. On it are based our national and many state livestock and crop reporting and estimating services, and numerous other statistical projections and estimates. National and local policies are built on its results.

It appears to the writer that nothing can contribute more to the improvement of the Census and that nothing should be more appreciated and welcomed by those responsible for its administration than a very active and lively interest on the part of all research agencies in determining the nature of its weaknesses and discussing and investigating methods of improvement. It is further important that agencies using the Census as a basis for either public or private policy should be guarded against its defects. It is even more necessary that they come to appreciate the indispensable character of its results when such results are accurate and capable of a consistent interpretation.

THE ALLOCATION OF HIGHWAY COSTS AMONG CLASSES OF MOTOR VEHICLES FOR PURPOSES OF CALCULATING GRADUATED TAX SCHEDULES[1]

By Arch D. Schultz, *Ohio Chamber of Commerce*

When Thomas H. MacDonald, Chief of the Bureau of Public Roads, appeared at the hearing of the Interstate Commerce Commission in Docket 23,400 on March 4 and 5, 1932, he stated that a 7½ ton truck equipped with pneumatic tires and operating at 30 miles per hour required a concrete road of thickness 15 per cent greater than that required for a seven passenger automobile. Furthermore, said Mr. MacDonald, if such a truck is equipped with cushion tires and operates at only 20 miles per hour, an increased thickness of 31 per cent is required. If the truck is equipped with solid tires, the necessary thickness exceeds that for the seven passenger car by 42 per cent. Moreover, Mr. MacDonald indicated that if the roughness of the highway exceeds that of fair sheet asphalt, even heavier construction is required. These statements were based upon the results of engineering research.

Thus, engineering studies directed by an engineer of nation-wide fame offer data upon which may be based a method of calculating a distribution of roadway costs among various classes of vehicles. The problem is one of allocating the outlay for thicknesses, widths, and other construction requirements among the various classes of vehicles, proportioned among vehicles according to the construction costs necessitated by the operation of each class.

For some time the Bureau of Public Roads conducted experiments to determine the effect of climate and of stresses occasioned by the operation of various classes of vehicles on the service life of highways. These studies show that to resist the warping effect of the sun's rays and the effect of frost, the minimum thickness of a cement slab must not be less than 7 inches at edge and 6 inches at center except in the northern states where requirements are slightly greater. In the matter of the effect of vehicle operation it was found that loadings and types of tires are the most significant factors in damage caused by wheel impacts. Variation in operating speeds may be ignored up to 45 miles per hour. Furthermore, according to the engineers in the United States Bureau of Public Roads, curvature and grade are negligible factors.

It was ascertained that concrete roads designed to resist weather

[1] This is a revision of a paper prepared for the Ninety-fourth Annual Meeting of the American Statistical Association on December 29, 1932. Accident prevented its delivery there.

conditions provide sufficient thickness to carry without damage all passenger cars and 2 and 3 ton capacity trucks loaded only to rated capacity, if the loading of such trucks does not exceed a 5,600 pound rear wheel loading. Such trucks, however, must be equipped with dual tires of 6 and 7 inches in diameter. Commercial vehicles of the 3 ton class do not normally exceed 8,500 pounds and when fully loaded have a maximum gross weight of approximately 14,500 pounds. Traffic tests show that in the case of trucks, 60 to 80 per cent of this weight is carried on the rear axle. Thus, all trucks up to 3 ton capacity, if they are not overloaded, are within the maximum limit for rear wheel loads of 5,600 pounds. The thickness required for such loads is adequately provided for in the 7–6–7 inch highway, that is, the specification requirements to resist climatic effects.

However, when we come to the 5 ton capacity trucks, which when loaded have a gross weight of at least 22,000 pounds, an additional thickness of 8 per cent is required if the impact reaction during operation is to be fully resisted without damage to the highway. The tests made by the Bureau of Public Roads covered 9,000 pound rear wheel loadings, hardly adequate for most modern trucks rated to carry 5 ton loads. Further thickness is required for the 7½ ton trucks and for the 5 and 7½ ton vehicles not equipped with pneumatic tires. Practically speaking, few trucks are sold which are rated at 7½ tons capacity. Overloaded 5 ton trucks and large passenger busses fall into the class of 7½ and 10 ton vehicles.

What has been said of trucks applies to passenger busses since there is no difference, as far as the road is concerned, between the weight of passengers and the weight of property carried. Furthermore, the vehicle weight of large busses exceeds that of trucks—a 45 passenger bus normally weighs in excess of 20,000 pounds.

In addition to the weight of vehicles as a factor in highway costs, there is the factor of width requirements to accommodate traffic with reasonable safety. Private passenger cars do not normally exceed 6 feet in width. Motor busses as a class are 8 feet wide and often are 30 feet long. Motor trucks commonly are 8 feet, 6 inches in width and are as long as 80 feet. Thus, for safety, to accommodate these larger vehicles, an increased highway width is required, including especially designed curves both as to roadway width and radius of curvature.

With this brief review of fundamental facts, I wish to present a method for calculating a distribution of highway costs among various classes of vehicles which, with proper interpretation, will give some notion of the relative tax burden which may be assigned by a state to various classes of motor vehicle property. It is impossible in the

space available to include in this discussion the various refinements in the method or to apply the principle to any actual situation. It is thus impossible to consider miscellaneous items of expenditure in the highway program such as snow removal, traffic control, and bridges.

It is not possible to state incontrovertibly that any significant part of bridge costs should be attributed to heavy vehicles as distinguished from the ordinary passenger car and light truck. Bridges have to be designed to carry heavy loads which might be imposed upon them and which might not even reasonably be charged to motor vehicle traffic at all. For instance, bridges must be built to carry ditching machinery, road-building machinery, and other contingencies of heavy loading.

If it be true that heavier bridges have to be constructed to carry the heavier vehicles, they entail an unknown and incalculable additional cost above lighter specifications. There is tremendous variation in the cost of similar load capacity bridges, due to varying conditions of topography at the site. Thus, it is practically impossible to determine what, if any, extra costs are entailed in constructing bridges to carry a 15 ton vehicle instead of a 5 ton vehicle. Some estimates vary from 2 to 35 per cent. For these reasons it has seemed advisable to make no attempt to charge any part of the cost of bridges to heavy vehicles.

Because of certain engineering features of grade separation it cannot reasonably be said that large and heavy vehicles should bear any special charges for this purpose. It is commonly reported that a higher clearance, when the grade separation is undergrade, is required to accommodate large vehicles, particularly moving vans. As a matter of fact, under the engineering policy of most highway departments a minimum of 500 feet sight distance is allowed in all construction of grade separations. This means that an approaching vehicle must at all points along the highway be able to see the surface of the highway 500 feet ahead. Normally, a 14 foot clearance undergrade is required. Most vehicles do not require more than 13 feet of clearance. In those cases where 13 feet of clearance is adequate for sight distance, no extra charge can reasonably be placed against the larger vehicles, because the only additional cost which could be charged against them is the extra foot of excavation of subgrade. The total cost of this extra foot for a normal separation, at $.35 per square yard, does not exceed $300, an item too insignificant for allocation processes.

Paving costs on overheads and undergrades are adequately taken care of in the calculations to follow.

In the allocation of highway costs among vehicles the separation of maintenance and repair costs from new construction costs need not be made. This is true for two fundamental reasons:

(1) Highway development is a governmental function and normally will be continued as a public project and as a more or less fixed element in governmental budgets. The annual outlay will not greatly vary from year to year. The allocation of expenditure for either maintenance or new construction will be dictated largely by the physical condition of the highways in each jurisdiction.

(2) The distribution may be looked upon as being always one of new construction since the real cost to be charged against each vehicle is ideally that part of the total cost of a highway which is required to provide a road which that vehicle cannot destroy or damage. In other words, the vehicle must either pay for such a construction or be charged for the repairs or reconstruction.

For purposes of deriving indexes of relative costs to be allocated, it seems advantageous to distribute among various classes of vehicles the cost of one mile of concrete highway since the average cost of high type construction is well represented by the cost of concrete roadway. This is found to be approximately $30,000 per mile for a complete construction 20 feet wide, including subgrade, structures and small bridges. Furthermore the tests of the Federal Bureau of Public Roads were made upon such a surface.

To simplify the analysis, and because it is approximately correct, it will be assumed that $20,000 per mile represents the cost for the slab and $10,000 per mile the cost of subgrade. The item for subgrade may be somewhat high. The effect of this in the distribution of costs will be to undercharge the heavier vehicles.

It has seemed reasonable to charge to the larger vehicles the cost for widths over 16 feet. Specifications for safe operation of large vehicles require roads at least 20 feet wide, and it will therefore be assumed that the mile of highway upon which the calculation is based is 20 feet wide.

Chart I presents the point of view for distributing among six classes of vehicles the cost of a pavement 8½ inches thick and 20 feet wide. The plan shows the distribution of the cost of that part of a given slab which is required to resist climatic effects and the minimum width required for small vehicles, *among all classes of vehicles* proportioned according to the number of units in each class. The cost of 16 feet of the subgrade is similarly distributed.

The extra 4 feet in the width of the slab 7 inches thick and the 4 feet extra subgrade is charged equally to all vehicles over 3 tons capacity, since this block of the cost is required only for the wide and heavy vehicles.

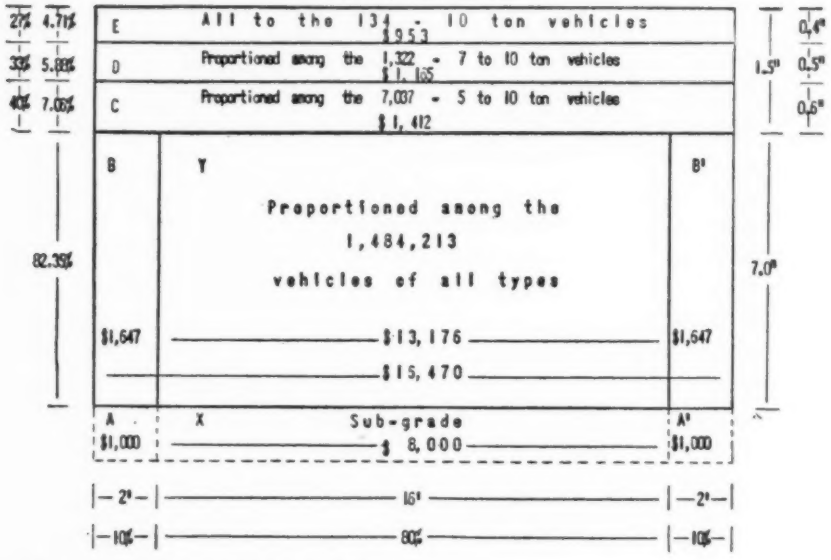
And finally, among the classes of heavy vehicles of over 3 ton capacity

the thickness over 7 inches which is required to resist impact reactions is distributed among the heavy vehicles according to the number actually in each class and the extra thickness required by each class.

CHART I

BASES FOR DISTRIBUTION OF COST

Highway Cross Section



Sections X and Y are chargeable to all vehicles.
Sections A, A¹, B, and B¹ are chargeable to all vehicles over 3 ton capacity.
Sections C, D, and E are chargeable only to heavy vehicles.

DISTRIBUTION OF COST OF CONSTRUCTION

Cost of subgrade and slab, $30,000, divided as follows: Subgrade 20 feet wide, $10,000; concrete slab 20 feet wide, $20,000.

Distribution of Subgrade Cost:

Section X = 80% of $10,000 or $8,000, distributable among all vehicles.
Sections A and A¹ = 20% of $10,000 or $2,000, distributable among heavy vehicles.

Distribution of Cost of Concrete Slab 20 Feet Wide:

Sections B, Y, and B¹ = 82.35% of $20,000 or $16,470.
Section Y = 80% of $16,470 or $13,176, distributable among all vehicles.
Sections B and B¹ = $16,470 − $13,176 or $3,294 ($1,647 for each section) distributable among all heavy vehicles.
Sections C, D, and E = $20,000 − $16,470 or $3,530.
Section C = 40% of $3,530 or $1,412.
Section D = 33% of $3,530 or $1,165.
Section E = 27% of $3,530 or $953.

In this distribution it is necessarily assumed that extra thickness of concrete is laid at proportionally extra cost.

Table I shows the necessary arithmetic calculations.

If it is intended to fix the schedule of license fees on the basis of re-

quired construction costs instead of a schedule arbitrarily determined, the rate relationship may be derived from the results of Table I. Table II shows the relative rate schedule derived from an allocation of

TABLE I

CALCULATION OF DISTRIBUTION OF COST OF ONE MILE OF CONCRETE HIGHWAY AMONG CLASSES OF VEHICLES

(Pneumatic Tires)

A. *Basic Data*

Class of vehicles	(1) Estimated maximum gross weights* (pounds)	(2) Estimated average rear axle loading* (pounds)	(3) Actual rear wheel loads at tests (pounds)	(4) Actual test maximum impact force (pounds)	(5) Index of required minimum thickness to resist impact	(6) Actual required thickness of slab in inches
(1) Passenger cars...	7,000		1,750	5,100	1.000	7.0–6.0–7.0
(2) 2 ton trucks.....	8,500	6,000	4,400	7,900	1.000	7.0–6.0–7.0
(3) 3 ton trucks.....	12,750	9,053	5,600	9,200	1.000	7.0–6.0–7.0
(4) 5 ton trucks.....	21,250	15,300	9,000	12,500	1.077	7.6–6.5–7.6
(5) 7½ ton trucks..	31,875	23,269	11,000	14,600	1.154	8.1–6.9–8.1
(6) 10 ton trucks....	42,500	31,875			(Est.) 1.220	8.5–7.3–8.5

* Includes load.

B. *Bases of Distribution*

Class of vehicles	(7) Estimated weight of vehicles (pounds)	(8) Number of vehicles in a given state	(9) Per cent of total	(10) Number of vehicles over 3 tons	(11) Per cent of total	(12) Number of vehicles over 5 tons	(13) Per cent of total
(1) Passenger cars	6,000	1,335,912	90.008				
(2) 2 ton trucks...	4,500	134,717	9.077				
(3) 3 ton trucks...	7,500	6,547	.441				
(4) 5 ton trucks...	11,250	5,715	.385	5,715	81.22		
(5) 7½ ton trucks	16,875	1,188	.080	1,188	16.88	1,188	89.86
(6) 10 ton trucks..	22,500	134	.009	134	1.90	134	10.14
Total.....		1,484,213	100.000	7,037	100.00	1,322	100.00

C. *Distribution of Cost of Sections of Roadway among Classes of Vehicles*

Class of vehicles	(14) Section X. Basis, column 9	(15) Section Y. Basis, column 9	(16) Sections A, A1. Basis, column 11	(17) Sections B, B1. Basis, column 11	(18) Section C. Basis, column 11	(19) Section D. Basis, column 13	(20) Section E	(21) Total of columns (14) to (20)	(22) Column (21) divided by column (8)
(1) Passenger cars..	$7,201*	$11,859						$19,060	$0.014
(2) 2 ton trucks....	726	1,196						1,922	0.014
(3) 3 ton trucks....	35	58						93	0.014
(4) 5 ton trucks....	31	51	$1,624	$2,675	$1,147			5,528	0.967
(5) 7½ ton trucks**.	6	11	338	556	238	$1,047		2,196	1.848
(6) 10 ton trucks**..	1	1	38	63	27	118	$953	1,201	8.963
Total.....	$8,000	$13,176	$2,000	$3,294	$1,412	$1,165	$953	$30,000	

* $7,201=90.008 per cent of $8,000.

** Also may refer to 25–29 and 35–50 passenger busses.

construction costs which is necessary to replace a total annual license fee revenue of $15,000,000. The data in columns (1) and (2) are derived from an enumeration of motor vehicles by classes.

TABLE II

DISTRIBUTION OF REGISTRATION FEES AMONG VEHICLES REQUIRED TO REPLACE TOTAL LICENSE FEES OF $15,000,000

Class of vehicles	(1) Maximum vehicle weights (pounds)	(2) Number of vehicles	(3) Experimental and interpolated basic rates	(4) Total revenues	(5) Basic rates times $15,000,000 / $28,631,315 (.524)
Passenger cars	6,000	1,335,912	$14	$18,702,768	$7.34
¼– 2 ton trucks and trailers	6,500	167,711	20	3,354,220	11.48
2– 3 ton trucks and trailers	7,500	4,430	45	199,350	23.58
3– 4 ton trucks and trailers	9,500	5,415	200	1,083,000	104.80
4– 5 ton trucks and trailers	12,500	3,703	967	3,580,801	506.71
25–29 passenger busses, and trucks	18,500	1,292	1,200	1,550,400	628.80
30–50 passenger busses, and trucks	24,500	87	1,848	160,776	968.35
Total		1,518,550		$28,631,315	

The ideal tax against motor vehicles would be that required for the support of the particular units of highways which a given class of vehicle utilizes. For instance, the private passenger automobile may be thought of as using the entire highway net of the state; local delivery trucks, only the streets of a given city; and inter-city busses, only those highways upon their specific routes. The foregoing suggestion has been applied to an hypothetical highway net as a whole and illustrated an allocation covering an entire highway system.

The proper use to be made of the method suggested, however, is to apply it to a separation of the state highway net into such groups as operating conditions warrant. A separate allocation process should be worked out for each of these groups based upon a proportioning of the different classes of vehicles operating on each of the highway groups, after determining a standard highway per mile cost for each of the classes of roads involved.

TESTS OF SIGNIFICANCE IN APPLYING WESTERGAARD'S METHOD OF EXPECTED CASES TO SOCIOLOGICAL DATA

By Samuel A. Stouffer, *University of Wisconsin* and Clark Tibbitts, *University of Michigan*

Westergaard's method of expected cases, as adapted by Woodbury,[1] seems to have possibilities of rather wide applicability in social studies where the unit is the individual and none of the factors studied are in quantitative form. It is important particularly because it provides a method of studying the relationship between two factors with one or more other factors held constant.

The purpose of this paper is two-fold: (1) The writers point out that the expected frequencies found by the Westergaard method are identical with the expected frequencies calculated in well-known tests of significance; and illustrate two out of various possible methods of interpreting the results of the Westergaard procedure in terms of probability. (2) The writers indicate, with numerical data on parole violation, a type of sociological material to which the Westergaard method, with appropriate tests of significance, seems particularly applicable. No new contribution to statistical theory is attempted. The writers simply have applied relatively well-established techniques in a new setting and have not hesitated here and there to retrace rather familiar ground, in the interest of readers who might like to make further practical applications.

Table I summarizes an analysis of two factors associated with success or failure on parole. It is thought that a punishment record for infraction of prison rules is associated with success or failure on parole, when failure on parole is defined as getting caught for violating parole. Consecutive records, obtained by Tibbitts, of 2,963 parolees from the Illinois State Reformatory, 1920–28, show that among parolees with no institution punishment record there were 405 violators of parole, or 221.7 per 1,000; among parolees with a record of one or two punishments there were 248 violators, a rate of 338.0 per 1,000; among parolees with three or more punishments there were 151 violators, a rate of 354.5 per 1,000.

[1] Harald Westergaard: *Die Lehre von der Mortalität und der Morbilität*, Jena, 1882, pp. 28–30; "Scope and Method of Statistics," this Journal, XV (1916) pp. 260–64. Robert M. Woodbury: "Westergaard's Method of Expected Deaths as Applied to the Study of Infant Mortality," this Journal, XVIII (1922) pp. 366–376; *Infant Mortality and Its Causes*, Baltimore, 1926. Chapter IV of this volume, in which the method is explained, is largely a reprint of Woodbury's paper in this Journal above cited.

It might be, however, that the apparent differences in violation rate among prisoners are merely a function of some other factor or factors. For example, parolees with no criminal record previous to commitment to Pontiac violated parole at a rate of only 217.2 per 1,000, as compared with a violation rate of 412.5 per 1,000 among parolees with a peni-

TABLE I

DATA FOR ANALYZING THE EFFECT OF PUNISHMENT RECORD IN PRISON ON PAROLE VIOLATIONS, APART FROM THE EFFECT OF PREVIOUS CRIMINAL RECORD

Records of 2,963 Parolees from Illinois State Reformatory, 1920–1928

Punishment record while in reformatory		Previous criminal record					Total*
		No previous criminal record	Record of fine or probation	Industrial school record	Jail record	Penitentiary or reformatory record	
No punishment	Total parolees	1284	150	156	164	73	1827
	Observed violators	248	32	48	51	26	405
	Expected violators	278.89	40.08	63.63	58.18	30.11	470.89
	$n_s p_s q_s$	218.31	29.37	37.68	37.54	17.69	340.59
	χ^2	4.37	2.22	6.48	1.37	0.95	15.39
	χ	−2.1	−1.5	−2.5	−1.2	−1.0	−3.6
1 or 2 punishments	Total parolees	397	68	99	99	47	710
	Observed violators	102	22	54	41	21	240
	Expected violators	86.23	18.17	40.38	35.12	19.39	199.29
	$n_s p_s q_s$	67.50	13.32	23.91	22.66	11.39	138.78
	χ^2	3.68	1.10	7.76	1.53	0.23	14.30
	χ	+1.9	+1.0	+2.8	+1.2	+0.5	+3.5
3 or more punishments	Total parolees	202	44	76	64	40	426
	Observed violators	59	16	33	24	19	151
	Expected violators	43.88	11.76	31.00	22.70	16.50	125.84
	$n_s p_s q_s$	34.35	8.62	18.35	14.65	9.69	85.66
	χ^2	6.68	2.09	0.22	0.12	0.64	9.73
	χ	+2.6	+1.4	+0.5	+0.3	+0.8	+2.2
Total	Total parolees	1883	262	331	327	160	2963
	Observed violators	409	70	135	116	66	796
	Violators per 1,000	217.207	267.176	407.855	354.740	412.500	268.647
	χ^2	14.71	5.41	14.46	3.02	1.82	39.42
	P	<.01	.07	<.01	.22	.41	<.01

*All entries except the last in each cell of this column are the sum of the entries in the corresponding row. For $\chi^2=15.39$, P <.01; for $\chi^2=14.30$, $P=.014$; for $\chi^2=9.73$, $P=.09$. The values −3.6, +3.5, and +2.2, as explained in the text, are obtained by referring the sum of the differences in a given row to its standard deviation $\sqrt{Sn_s p_s q_s}$. They are to be interpreted as deviates of a normal probability curve and the respective probabilities (considering algebraic sign) are <.01, <.01, and .014. The values called χ in the individual cells are also to be interpreted as normal deviates and their probabilities may be found by reference to a table of the normal probability integral.

tentiary or reformatory record previous to commitment to Pontiac. A larger proportion of the latter group was punished while in Pontiac than of the former group. Perhaps, punishment record, by itself, was not associated with success or failure on parole, except as the differences in violation rates by punishment record merely reflected the influence of previous criminal record.

Among the 1,883 prisoners who had no criminal record previous to

commitment to Pontiac, 409 violated parole, a violation rate of 217.207 per 1,000. If punishment record were not a factor, the violation rate in each classification according to punishment record would have been the same. We take as the best available estimate of this the rate of 217.207 per 1,000. Therefore, instead of having only 248 violators among the 1,248 with no punishment record, our expectation would be $.217207 \times 1248 = 278.89$. (The fraction is retained for accuracy in further computation.) Similarly, instead of having 102 violators among the 397 with a record of one or two punishments, our expectation would be only $.217207 \times 397 = 86.23$. Finally, instead of having 59 violators among the 202 with three or more punishments, our expectation would be only 43.88.

These differences are large enough to suggest that punishment record did make a difference in the violation rates of the 1,883 parolees with no previous criminal record. Unless differences are obviously very great, it is important, before drawing conclusions, to see whether they might be accounted for by chance. Using the conventional formula for the standard error of a frequency, $\sqrt{npq}$, we find that each of these differences is significant, in the sense that it would be unreasonable to account for it by chance. For example,

$$\chi = \frac{248 - 278.89}{\sqrt{1248 \times .217207 \times .782793}} = -2.1$$

a negative normal deviate of a size occurring by chance less than once in fifty samples.

An analogous procedure may be carried through in the other four classifications according to previous criminal record. Table I shows in each sub-group the total number of prisoners; the number of observed and expected violators; the value of $\sqrt{npq}$; the value of χ, the normal deviate; and the value of χ^2, to be discussed later in this paper.[1]

SIGNIFICANCE OF THE SUM OF THE DIFFERENCES BETWEEN OBSERVED AND EXPECTED VIOLATORS

For some purposes, a study of the results as reported in the individual sub-groups may be sufficient. If it is desired to summarize the results, a method developed by Woodbury, is readily available. We may ask the question: If punishment record had not been a factor, how many expected violators would we have had among the 1,827 with no punishment records, as compared with the 405 observed violators found by adding the number of observed violators in each classification according

[1] The procedure is valid subject to the usual limitation that n and p must not be too small to justify using the normal curve as an approximation to the binomial expansion.

to previous criminal record? The sum of our five sets of expected violators is 470.89.

As before, we may inquire whether the difference between 405 and 470.89 is large enough to be reasonably accounted for by chance.[1] One method is simply to compute $\frac{n_o - np}{\sqrt{npq}}$, where n_o is the observed frequency, 405; n is the total number of parolees, 1827; p is the proportion of expected violators, $470.89/1827 = .257739$; and $q = 1-p$; yielding a value of $\sqrt{npq} = 18.70$ and indicating a significant normal deviate of -3.6.

An objection may be raised to this procedure on the ground that the expected number of violators, 470.89, is the sum of several expected frequencies based on varying estimates of p. The objection is certainly sound, theoretically. It may be questioned how serious it is, practically. A better estimate of the standard deviation than $\sqrt{npq}$ as above defined probably would be $\sqrt{Sn_sp_sq_s}$, where, in the s'th classification by previous criminal record, n_s is the number of parolees, p_s is the expected proportion of violators, and $q_s = 1-p_s$. If we use this formula, we assume that our sum of observed violators, 405, is obtained from five independent subsets, the s'th subset being drawn from a hypothetical infinite population of possibilities in which the true proportion of violators is p_s. If we drew repeated samples of n_s parolees from this population with a fixed p_s, the observed numbers of violators in each sample would vary around the mean of n_sp_s with a variance of $n_sp_sq_s$ and the sum of the observed numbers of violators in all the samples drawn from each subset would vary around the expected number Sn_sp_s with a variance equal to the sum of the s individual variances. As is well known,[2] $Sn_sp_sq_s = npq - Sn_s(p_s-p)^2$. Our improved estimate of the variance always will be smaller than npq. In practice, however, the term $Sn_s(p_s-p)^2$ usually will be very small as compared with npq. In Table I the root of the sum of the five variances in the first row is equal to 18.46, as compared with $\sqrt{npq} = 18.70$, showing that the latter is in error by only a little over 1 per cent,

[1] Woodbury remarks: "In general, the calculation of such probabilities is likely to be misleading rather than helpful, since it tends to divert attention from the need of interpreting correlation in terms of real causes." (*Infant Mortality and Its Causes*, p. 58.) The same may be said, of course, of almost any study where a calculation of standard error inhibits further analysis. This is the fault, however, not of the standard error but of its user. Unless one has a vast number of cases, one is bound to find himself face to face many times with the task of trying to estimate whether an effect can be attributed to any cause other than chance; and it behooves him to satisfy himself by sound logical devices before he proceeds to the next step of asking, "Chance is not the cause; now is the real cause A, or is it B, C or D or all four of them?" Moreover, the present problem of testing significance, as this paper attempts to indicate, is relatively simple, not "abstruse" as Woodbury feared it would be. (*Op. Cit.*)

[2] Cf. H. L. Rietz, *Mathematical Statistics*, Chap. VI.

surely trivial considering the other errors implicit in the data. The values of $Sn_s p_s q_s$ for each classification by punishment record are given in the last column in Table I.

The aggregate number of observed violators in each of the classifications according to punishment record evidently differs from the expected number by an amount greatly in excess of what would be expected by chance if punishment record were not a discriminating factor. Of course, punishment record might still be a function of some third or fourth factor and not of itself really discriminating as between violators and non-violators.

TESTING SIGNIFICANCE BY THE χ^2 METHOD

Let us now introduce a somewhat different approach to the problem of testing whether the differences between observation and expectation may have arisen by chance.

Again, let us consider only those prisoners with no previous criminal record (Table II). By the usual χ^2 method we can estimate the numbers of violators and non-violators which we would have in each sub-class if chance alone accounted for the distribution, and if we drew repeated samples from a hypothetical infinite population in which the marginal frequencies were fixed. The expected numbers of violators would be

TABLE II

PAROLEES WITH NO PREVIOUS CRIMINAL RECORD

Punishment record	Violators	Non violators	Total
No punishments	$_1n_1 = 248$	$_2n_1 = 1036$	$n_1 = 1284$
1 or 2 punishments	$_1n_2 = 102$	$_2n_2 = 295$	$n_2 = 397$
3 or more punishments	$_1n_3 = 59$	$_2n_3 = 143$	$n_3 = 202$
Total	$_1n = 409$	$_2n = 1474$	$n = 1883$

exactly the same as those calculated by the Westergaard method, the expected number of violators with no punishment record, for example, being $409/1883 \times 1284/1883 \times 1883 = 278.89$, as before. We now test the hypothesis that the six observed entries in the table could have appeared by chance from a population yielding the given set of expectations. We have $\chi^2 = 14.71$, which is seen to be significant upon entering Elderton's or Fisher's table of χ^2 and P, allowing two degrees of freedom.[1] Our interpretation is that among parolees with no pre-

[1] That there are only two degrees of freedom is evident from the fact that all but two of the six expected values could have been filled in from the marginal totals by mere subtraction. If we had begun with some more complex hypothesis about the population from which we were sampling, the choice of degrees of freedom might have been different.

vious criminal record, the factor of punishment record does discriminate violators and non-violators to an extent greater than can reasonably be accounted for by chance. Repeating the procedure for other classifications by previous criminal record, we find that punishment record also discriminates in the case of those with an industrial school record, possibly in the case of those with a record of fine or probation, and probably not in the case of those with a jail record or with a penitentiary or reformatory record. The values of χ^2 and P appear at the foot of the columns in Table I. One must be cautious about comparing one of these groups with another, because they are based on different total numbers of cases. If the men with penitentiary or reformatory records had been as numerous as those with no previous criminal record it is quite possible that the value of χ^2 for the former group would have been as large as that for the latter group. χ^2 is not a measure of association; it is merely a measure which enables us to test a hypothesis as to the significance of discrepancies in a sample of the size observed. If the marginal frequencies keep their same proportion to the total, the value of χ^2 increases directly in proportion to the increase in the total.

The χ^2 method, as we have just seen, answers a question which is different from that which we were considering in the preceding section of the paper.[1] For some purposes, this question may be very interesting. The χ^2 method has another valuable property, in that it enables us to pool the results for each classification by previous criminal record and test our entire table at one stroke. Since the five values of χ^2 are independent of one another, we may add them and refer their sum to a table of χ^2 and P, which we enter with $5\times2=10$ degrees of freedom. The result, entered in Table I at the foot of the last column, shows that, taken as a whole, the discrepancies between observation and expectation are greater than can reasonably be accounted for by chance.

In computing χ^2 for prisoners with no previous criminal record, we performed, in a sense, a controlled experiment in that the group was presumably homogeneous in having no previous criminal record. Similarly, in computing χ^2 for any of the other classifications we controlled criminal record. By our method of pooling the results of separate controlled studies we have a final figure in which the factor of previous criminal record is still controlled or held constant, permitting

[1] Different in the sense that the χ^2 method tests the significance of the discrepancies, taken as a whole, between observation and expectation, in a particular *column*. The former procedure, which tested the sum of the discrepancies in a particular *row*, is inapplicable to a column because the sum of the differences between observed and theoretical frequencies in a column is necessarily zero. Hardly necessary to add, the distinction between row and column is made solely with reference to Table I. It implies no qualitative difference between rows and columns other than is arbitrarily imposed by the arrangement of the table.

us to interpret the likelihood of chance accounting for the *net* discrepancies among all violators classified according to punishment record.

It happens that the labor of computing χ^2 in a $2 \times t$ table may be shortened by taking advantage of the fact that χ^2, which, by the usual definition, $= \sum_{s=1}^{t} \frac{({}_1n_s - n_s p)^2}{n_s p} + \sum_{s=1}^{t} \frac{({}_2n_s - n_s q)^2}{n_s q}$, reduces to $\sum_{s=1}^{t} \frac{({}_1n_s - n_s p)^2}{n_s pq}$, where ${}_1n_s$ and ${}_2n_s$ are frequencies in sub-groups in the first and second columns, respectively, of the s'th row.[1] The components of χ^2 in any such table are evidently merely the squares of the values which we took earlier in our paper as normal deviates in testing the significance of the discrepancies between observed and expected violations in the individual cells. The same arithmetical procedure which leads to χ^2 may be used, therefore, in calculating the values needed in the Westergaard method as adapted by Woodbury and needed in testing[2] the significance of a sum of discrepancies by finding its ratio to the standard deviation $\sqrt{\Sigma n_s p_s q_s}$.

A given component of χ^2, such as $\frac{({}_1n_s - n_s p)^2}{n_s pq}$, may, in fact be interpreted as a value of χ^2 with one degree of freedom.[3] This suggests a method of answering still another question in Table I. Consider the discrepancies along the first row, including all prisoners with no punishment record. Previously, we found by adding the number of observed violators and the number of expected violators, and dividing by

[1] Remembering that $q = 1-p$ and ${}_2n_s = n_s - {}_1n_s$, we have

$$\chi^2 = \sum_{s=1}^{t} \frac{({}_1n_s - n_s p)^2}{n_s p} + \sum_{s=1}^{t} \frac{(n_s p - {}_1n_s)^2}{n_s(1-p)} = \sum_{s=1}^{t} \frac{({}_1n_s - n_s p)^2}{n_s} \left(\frac{1}{p} + \frac{1}{1-p}\right) = \sum_{s=1}^{t} \frac{({}_1n_s - n_s p)^2}{n_s pq}.$$

The writers' attention to this result was called by Dr. E. S. Pearson, University College, London, who also made other helpful suggestions regarding the application of the χ^2 test.

[2] The arithmetic may perhaps be reduced to its simplest form by again considering Table II, only the first column and the outside totals of which are now needed. The steps are as follows: (1) Calculate $p = 409/1883$, and $q = 1-p$. (2) Place p in the calculating machine and multiply successively by 1284, 397, 202; entering the products in the table, just below the observed frequencies. These products represent the expected number of violators. (3) Subtract the expected numbers from the observed numbers. (4) Check steps (1), (2), and (3), by adding the differences; which should be zero, within the limits of rounding. (5) Place q in the calculating machine and multiply successively by the expected frequencies, giving the values of $n_s pq$; multiply also by the total number of violators, 405, thus checking the accuracy of the individual values of $n_s pq$ if q has been entered in the machine correctly. (6) Square the differences between observation and expectation and divide by the corresponding $n_s pq$. The only check on this step is division or repeating of the operation. (7) Find the square roots, which may be taken as a normal deviate if n and p are not too small. This procedure was followed in calculating the entries in Table I.

[3] Referring χ^2 to a table of P (χ^2) with one degree of freedom (the most complete table with one degree of freedom is found in Yule, *Introduction to the Theory of Statistics*, 7th edition, pp. 288–9) one will make exactly the same interpretation with respect to chance as in referring the square root χ to a table of the normal curve. The value of P in the table of P (χ^2) is equal to the sum of the probability of getting a value of χ greater than $+\chi$ and of the probability of getting a value of χ less than $-\chi$.

$\sqrt{Sn_s p_s q_s}$, that the difference between the two sums was too large to be considered due to chance. Let us suppose, for purposes of argument, that we had found that the difference between the two sums was very small as compared with $\sqrt{Sn_s p_s q_s}$. Then we would rightly say that the difference easily could be accounted for by chance. We still could hardly make the blanket statement that our five samples of prisoners with no punishment record were drawn by chance from a hypothetical population in which punishment record had no effect on violation rates. It might still be true that punishment record was a factor in the case of each individual sample of the five, but that it had opposite effects in one sample from its effects in other samples. A large positive difference between observed and expected violators in the group with no punishment record, for example, might be so nearly cancelled by a large negative difference in the group with a jail record that the sum of the differences would be negligible. Yet each difference, considered by itself, might be too large to be accounted for by chance. If we simply add the values of χ^2 for each group we can test whether such a simultaneous set of discrepancies as found in the five groups could be attributed to chance. Each of the five values of χ^2 is based on one degree of freedom; hence we refer their sum to a table of $P(\chi^2)$ with five degrees of freedom.[1] One should keep clearly in mind that the results of this test are likely to be different from the results of relating the sum of the differences to their standard deviation $\sqrt{Sn_s p_s q_s}$, because the two methods are testing *two entirely different hypotheses.*

The fact that two different hypotheses are available should be no more confusing in this case than in any other inquiry. Consider, for example, the question as to whether the mean of a given sample arose by chance from a population with a given mean and standard deviation. One can test this hypothesis, and it may be entirely sufficient for the purposes of a given inquiry. Or one can test another hypothesis, namely, that the frequencies in the class intervals of a given sample could have arisen by chance in sampling from a population with given frequencies in the corresponding class intervals. This, too, is a perfectly legitimate hypothesis, and may be answered in the negative when the former hypothesis is answered in the affirmative, or *vice versa.* (Indeed, these are only two out of many legitimate hypotheses which we might test.) The danger of loose thinking arises when one fails to formulate a hypothesis exactly and falls into the common error of saying, "The effect of this factor is or is not attributable to chance"

[1] See R. A. Fisher, *Statistical Method for Research Workers*, Chap. IV, especially Section 22.

instead of saying, "The effect of this factor, *as measured in such and such a way*, is or is not attributable to chance."

Which of the two different methods of analyzing the results in the first row of Table I is desirable, is entirely a matter of the purpose of the investigator. If his interest is primarily in the comparison of the difference between the sum of the observed and expected violators, namely, 405 and 470.89, it would seem that the logical treatment is to compare this difference with its standard deviation $\sqrt{Sn_s p_s q_s}$, or with its possibly sufficiently accurate approximation, $\sqrt{npq}$. If most of the differences observed in the five sub-groups are of the same algebraic sign, he may not feel any need to inquire further. If the differences between the sums are small and if there are striking differences with opposite algebraic signs in the sub-groups he may desire to *shift his attention* from a consideration of the difference between the sums to a consideration of the individual discrepancies. Then the χ^2 test, obtained by summing the individual values of χ^2 across a row, may be in order.

In fact, the difference between 405 and 470.89 in the first row of Table I is much too large to be attributed to chance and the individual differences between observed and expected violators are all negative. The answer as to the effect of punishment record, as measured by comparing 405–470.89 with $\sqrt{Sn_s p_s q_s}$, is therefore decisive. If this is decisive, it would seem irrelevant in the present inquiry whether the differences within the sub-groups of a given row, when considered individually and then pooled for purposes of summary by use of the χ^2 test, are attributable to chance or not. The pooled values of χ^2 are entered in each row of Table I. The value of χ^2 for those with no punishment record is significant; χ^2 for those with one or two punishments is possibly significant; χ^2 for those with three or more punishments is not significant and may be attributed to chance. In all cases, however, the values of the sum of the differences between observed and expected violators are significant, exceeding their standard deviation by more than two times.

In the present problem, the χ^2 method is mainly of value (1) in enabling us to appraise the effect of punishment record in violation rates for all parolees in each of the five individual classifications by previous criminal record; and (2) in enabling us to summarize the discrepancies between observed and expected violators over the entire table, by adding these five values of χ^2 and referring to a table of P (χ^2) with 10 degrees of freedom. These two problems differ from the main quest of the Westergaard-Woodbury procedure and yield supplementary information which should be of interest in many cases. The third use to

which the χ^2 method was put, in adding the values of χ^2 for each row, probably would have been of interest only if the difference between the sums of observed and expected violators in a given row were small.

To sum up, we have indicated the uses of two general procedures for testing for chance the discrepancies between observation and theory in a table constructed by the Westergaard method as adapted by Woodbury. In our example, we have seen that as a whole a record of punishment while in prison discriminated significantly between violators and non-violators of parole, making full allowance for the effect of previous criminal record; although the number of prisoners with a previous criminal record of jail sentence or of penitentiary sentence was not large enough to give us confidence that it discriminated significantly in these two groups.

The further question remains as to whether punishment record is merely a function of some other factor, such as type of crime for which committed to Pontiac, urban or rural background of the prisoner, etc. The method of expected cases enables us to analyze as many other factors as we wish, though the labor increases in geometric ratio with the number of factors. The 1,883 parolees with no previous criminal record may be sub-divided not only into three rows according to punishment record but also into, say, five columns according to type of crime for which sentenced. Expected violations in each new subgroup may be computed as before. Since there are five groups by previous criminal record the sum of our expected violators among those with no punishment record will be compounded of 25 entries. We can test significance of the difference between 405 and this sum by the same method as before, although many of the sub-groups will now be too sparsely populated to justify the reference to their individual differences to a table of the normal curve. We can use the χ^2 test for any sections of the table where it will answer a question of interest, provided we include no sub-groups with less than 2 or 3 expected violators. (Some would place the minimum limit at 5, although this seems unnecessarily conservative.)

Finally, it should be understood that the procedures illustrated by the writers are only a selection out of several possible approaches to the problem of testing significance. They were selected primarily because of their simplicity. It is hoped that this paper will encourage the further consideration of these and other approaches and the appraisal of their respective merits.

THE AMERICAN FAMILY INCOME AND PROSPERITY

By Louis Bader, *New York University*

The purpose of this paper is to invite attention to the importance of the family in our economic activity. It does this by suggesting a distribution of family income in the United States in 1932, making a comparison of that distribution with a distribution for 1928, and then by means of other data, indicates the effects of this change in family incomes on the economic activity of the country. The family is selected because it still is the principal consumption unit, and what industry, farm, forest, and mine are to produce depends, for the most part, on the wants of individuals as expressed through the family purse. There are, of course, many factors which are effective in directing consumption, but probably the most important is income. This paper examines the income and the relations between income and family expenditures and the effect of these expenditures on production, employment, prices, and profits.

In a recent estimate of income distribution in the United States for 1928, Dr. W. I. King [1] arrives at the following figures: an income [2] of $84,803,698,000 distributed among 46,704,965 personal recipients. He breaks this down into class intervals of $200 in size. If we summarize King's more detailed figures we get the distribution as shown in Table I.

TABLE I

NATIONAL INCOME AS DISTRIBUTED AMONG RECIPIENTS IN 1928

Income (dollars)	Number of persons	Total income (thousands of dollars)	Average income per person (dollars)
Under 1,000	10,014,000	7,463,600	745
1,000 to 2,000	27,542,000	39,468,200	1,433
2,000 to 3,000	6,629,000	15,484,300	2,335
3,000 to 5,000	1,397,000	5,210,900	3,730
5,000 and over	1,122,965	17,176,698	15,296

From this we can construct a cumulative per cent distribution as indicated in Table II.

These individual income recipients are not each the sole supporter of a family; consequently it becomes necessary to develop an estimated distribution of family incomes. Leven has done this for The Committee on the Cost of Medical Care based on King's 1928 income distribution, and a summarization of his findings is shown in Table III.

Taking the mid-point of each income range as the average for the

[1] From unpublished data compiled by Dr. W. I. King.

[2] Money and commodity income.

TABLE II

CUMULATIVE PER CENT DISTRIBUTION OF INCOME RECIPIENTS AND INCOMES IN GIVEN INCOME GROUPS

Upper limit of income group (dollars)	Cumulative percentages	
	Number of recipients	Income received
1,000	21.4	8.8
2,000	80.4	55.8
3,000	94.6	74.0
5,000	97.6	80.1
Indefinite	100.0	100.0

TABLE III

ESTIMATED DISTRIBUTION OF FAMILIES ACCORDING TO AMOUNT OF ANNUAL INCOME, 1928 *

1928 Income (dollars)	Number of families	Per cent	Cumulative per cent
All incomes	29,000,000	100.0	.....
Under 1,000	4,060,000	14.0	14.0
1,000 to 2,000	11,977,000	41.3	55.3
2,000 to 3,000	6,235,000	21.5	76.8
3,000 to 5,000	4,060,000	14.0	90.8
5,000 and over	2,668,000	9.2	100.0

* Estimated by Dr. Maurice Leven from Dr. Willford I. King's estimated distribution of individual income recipients and other data. The families are "census" families and include approximately 2,286,000 households of one person. In addition to the families distributed here there were in 1928, approximately 6,400,000 gainful workers outside the family units as designated by the census. *The Ability to Pay for Medical Care*, p. 11.

group and multiplying by the number of families in the group we get the total income for each group. This is shown on Table IV which indicates the family income in the United States as distributed by dollars.

TABLE IV

ESTIMATED FAMILY INCOME AS DISTRIBUTED BY DOLLARS IN 1928

Number of families	Total income of group (thousands of dollars)	Per cent	Cumulative per cent	Average family income (dollars)
29,000,000	84,803,698	100.0	.....	2,924
4,060,000	2,030,000	2.4	2.4	500
11,977,000	17,965,500	21.2	23.6	1,500
6,235,000	15,587,500	18.3	41.9	2,500
4,060,000	16,240,800	19.1	61.0	4,000
2,669,000	32,980,698	39.0	100.0	12,424

These are family incomes in a year regarded as one of the most prosperous in the history of the United States. Productive machinery generally was kept in active operation; employment was at better than average levels; real wages were at comparatively high levels and prices for most products were on a profitable basis. In a few years this was changed to a condition almost completely opposite. Meanwhile what

had happened to family incomes? Students of the national income suggested that for 1932 it was no more than half that of 1928. Should this actually be the case then our national money income in 1932 totalled about $42,401,849,000. This reduced total played havoc with the family income, for not only was the income cut in half, but, between 1928 and 1932 there was a substantial increase in the number of families. The census of 1930 reported 29,904,663 families [1] consisting of a total of 122,775,046 persons. Between the census of 1930 and the mid-year of 1932 it is estimated the population increased by 2,046,954 persons.[2] Since the census estimates private families as averaging 4.01 persons,[3] and making allowance for single, unattached persons, we may assume 30,400,000 families for 1932. Assuming also that these families are distributed as to income in the same degree as shown in Table III for 1928 incomes, we get Table V, showing estimated distribution of families according to annual income in 1932, before modification is made for the lower national income of 1932.

TABLE V

ESTIMATED DISTRIBUTION OF FAMILIES ACCORDING TO AMOUNT OF ANNUAL INCOME (1932)

1932 Income (dollars)	Number of families	Per cent	Cumulative per cent
All incomes	30,400,000	100.0	.....
Under 1,000	4,256,000	14.0	14.0
1,000 to 2,000	12,555,200	41.3	55.3
2,000 to 3,000	6,536,000	21.5	76.8
3,000 to 5,000	4,256,000	14.0	90.8
5,000 and over	2,796,800	9.2	100.0

But the national money income is only half in 1932 of that of 1928, so that if we assume the income is distributed in dollars in the same way as in 1928 as indicated in Table IV we get the dollar distribution as shown in Table VI. This would seem to be a fair assumption since all income groups have suffered, due to decreases in all forms of income.

These family incomes may in some cases seem very small but even if the total money income were to be equally distributed among all the families each one would average roughly only $1,400 for the year. Studies of income and wages suggest that incomes are most unevenly distributed in the United States,[4] and consequently no great stretch of the imagination is necessary to believe that family incomes in the disastrous year of 1932 were roughly as indicated above.

[1] *Statistical Abstract of the United States*, p. 42.

[2] *Ibid.*, p. 3.

[3] *Ibid.*, p. 42.

[4] King's estimated distribution of national income in Table I, Douglas, *Real Wages in the United States*, 1890–1926, 1930; and annual reports, United States Treasury Department, *Statistics of Income*.

As is to be expected when the national income is cut in half, many families are thrown into sharply lower income groups. In 1928 we had apparently a little over sixteen million families with annual incomes averaging $1,500 and less, and almost thirteen million families with yearly incomes averaging $2,500 and over. In 1932 the corresponding

TABLE VI

ESTIMATED FAMILY INCOMES AS DISTRIBUTED BY DOLLARS IN 1932*

Number of families	Total income of group (thousands of dollars)	Per cent	Cumulative per cent	Average family income (dollars)	
				Current	1928 †
30,400,000	42,401,849	100.0	.....	1,394	1,709
4,256,000	1,017,644	2.4	2.4	239	293
12,555,200	8,989,192	21.2	23.6	716	878
6,536,000	7,759,538	18.3	41.9	1,187	1,455
4,256,000	8,098,753	19.1	61.0	1,902	2,332
2,796,800	16,536,722	39.0	100.0	5,912	7,248

* Since data are not available to present an exact distribution of family income, this distribution is offered merely as a working hypothesis.

† Based on National Industrial Conference Board's Cost of Living Index, which showed a change between 1928 and 1932 from 100.4 to 77.7. Quoted in *Survey of Current Business*, February, 1933.

figures were more than twenty-three millions and one and one-quarter millions respectively, even after allowance is made for the increased purchasing power of the dollar. Business men and social workers alike, although for different reasons, are deeply interested in the question, "What happens when incomes are sharply reduced?" Obviously such a change would mean a drastic revision in type, quantity and quality of consumption, with resulting ill effects for business through decreased profits, and for the state through a possible lowering in the quality of its citizens, and smaller incomes subject to taxation.

The full significance of the relation between a sharp reduction in income and expenditures is not seen until one analyzes available family budget studies. Unfortunately family budget studies are not made regularly and on a sufficiently comprehensive scale, so that in this field also one must estimate considerably. There have been, however, enough isolated studies to indicate tendencies. A review of some of these studies will enable us to visualize better what probably happened between 1928 and 1932 with respect to consumer expenditures, and to suggest why the present depression has been so drastic and prolonged.

The major family budget studies in this country were those made by the Department of Labor covering American industrial workers' families in 1891, 1901 and 1919. The yearly family expenditures studied ranged from under $200 to $2,500 and over. These are summarized in Table VII.

The averages varied for the different incomes. The expenditures for food decreased sharply, ranging between 49.6 and 28.6 per cent; the expenditures for clothing and miscellaneous items increased materially, clothing ranging between 8.7 and 20.4 per cent; the miscellaneous

TABLE VII

SUMMARY OF OFFICIAL FAMILY BUDGET STUDIES *

Study income range (dollars)	Average expenditures percentage of total				
	Food	Clothing	Rent	Fuel and light	Miscellaneous
1891 Under 200 to 1,200.....	41.4	15.3	15.1	5.9	22.7
1901 Under 200 to 1,200.....	43.1	13.0	18.1	5.7	20.1
1919 Under 900 to 2,500.....	38.2	16.6	13.0	5.2	26.4

* Summarized from Table XLIII, Nystrom, *Economic Principles of Consumption*, p. 223.

expenditures ranging between 14.0 and 40.1 per cent; and the expenditures for fuel and light decreased, ranging between 8.1 and 4.1 per cent, as the total expenditures increased.

In between these studies many others [1] were made by sociologists for various interests, and these all show the same tendencies. Nearly all of them were of budgets of industrial urban workers, and of sub-normal families requiring relief. Since 1919 many other studies have been made, some of industrial workers, and others of professionals' families enjoying substantially larger incomes than those previously studied. Some of these are summarized in Table VIII.

It will be noticed in all of these studies that most families, as expenditures increase, spend considerably less of the total for food, and correspondingly more for miscellaneous items.[2] In this paper the miscellaneous expenditures cover everything other than food, clothing, and rent. In the few studies dealing with expenditures greater than $5,000 a year the expenditures for food decrease very sharply and miscellaneous expenditures increase just as sharply. For example in Piexotto's excellent study *Getting and Spending*,[3] food expenditures range between 9.1 and 18.1 per cent, and miscellaneous items between 52.1 and 71.2 per cent. When incomes decrease the reverse takes place. All the studies indicate that when incomes are low, say $1,200 and under, the expenditures for food range between 40 and 60 per cent; for housing between 12 and 24 per cent; and for clothing between 10 and 16 per cent, of all expenditures. These three items then account for between 62 and 100 per cent of all expenditures in the low income groups. The balance of the incomes is

[1] Berridge, Winslow, and Flynn, *Purchasing Power of the Consumer*, pp. 129–160.
[2] This was clearly shown by Ernest Engel as early as 1857. Quoted by Nystrom, *op. cit.*, p. 218.
[3] P. 133.

TABLE VIII

SELECTED STUDIES OF FAMILY BUDGETS MADE SINCE 1918 SHOWING PERCENTAGE OF EXPENDITURES FOR FOOD, CLOTHING, HOUSING, AND MISCELLANEOUS ITEMS

Study	Income (dollars)	Average and range expenditure percentage of total							
		Food	Range	Clothing	Range	Housing	Range	Miscellaneous	Range
Farmers* 2,886 families	Under 600–3,000	41.2	54.4–30.7	14.7	11.6–16.4	12.5	12.5–10.9	31.6	21.5–42.0
Federal employees† 506 families	Under 1,200–3,600	32.6	40.0–27.0	11.6	10.0–14.0	19.6	24.0–16.0	30.0	25.3–34.4
Ford employees‡ 100 families	Average 1,711.87	32.3	.....	12.2	.....	22.6	.....	32.9	.....
Street car men§ 98 families	Under 1,000–3,000	38.0	59.9–15.0	11.2	8.1–22.6	17.9	36.7– 3.4	33.0	27.1–53.2
Professional group‖ 802 reports	Under 1,000–6,500	23.3	36.5–18.8	12.7	10.6–17.9	23.3	24.1–18.7	40.7	27.0–47.3
East Side New York¶ 252 families	Average 3,968	29.0	.....	11.0	.....	15.0	.....	45.0	.....
Minimum budgets** Laborer's family, 1926.	2,010.72	32.3	.....	16.0	.....	22.8	.....	28.9	.....
Clerical workers, 1925	2,234.44	28.0	.....	19.5	.....	26.5	.....	26.0	.....
Suggested budgets	600–2,400	30.0	40.0–22.0	14.3	14.0–15.0	21.0	23.0–20.0	34.6	24.0–44.0

* U. S. Department of Agriculture, Bulletin No. 1466, *The Farmer's Standard of Living*, 1926.
† U. S. Department of Labor, *Cost of Living of Federal Employees in Five Cities*, 1929.
‡ International Labor Office, *An International Enquiry into Costs of Living*, 1931.
§ Cost of Living Studies IV. University of California Press. 1931.
‖ *Distribution of Expenditures and a Cost of Living Index for a Professional Group*, Ohio State University, 1932.
¶ Report of East Side Chamber of Commerce, *New York Times*, March 15, 1930.
** *A Family Budget*, Metropolitan Life Insurance Company.

used for fuel, light, medical attention, reading matter, carfares, entertainment, vacations, insurance, and luxuries such as candy, cigars, domestic household appliances, savings, and so on. It is apparent that in many cases nothing can be spent for these things and dependence is placed on charity, and in most cases the expenditures for the host of miscellaneous items will range between $100 and $200, which can take care only of the most necessary of the miscellaneous items like fuel, light, medical attention, carfares, and insurance. If the figures in Table VI are approximately correct then nearly all of the families in the United States are in the group sharply limited as to expenditures for miscellaneous items and we have the explanation of the drastic decline in business since 1929; families are not able to buy those products and services, the production of which gave us the prosperity of the era prior to 1929.

Again, if the figures in Table III are approximately correct we have the explanation of the prosperity of the era ending in 1929. Most families in this era averaged incomes which permitted of spending several times the sum available for miscellaneous items in 1932.

The devastating effects on business of the changes in family incomes between 1928 and 1932 are to be seen in production activities, employment, prices, and profits as shown in Tables IX and X.

TABLE IX

INDEXES OF PRODUCTION, EMPLOYMENT, AND WHOLESALE PRICES 1928 AND 1932*

(1923–1925=100)

Industries	Production index		Employment index		Wholesale price index	
	1928	1932	1928	1932	1928	1932
All industries	112	63	97.2	62.4	96.7	64.8
Manufactured foodstuffs	98	87	98.6	82.0	101.0	61.0†
Textiles	107	82	95.1	....	95.5	54.9
Anthracite coal	93	..	.....	....	84.3‡	70.3
Automobiles	110	35	108.8	....	.....	.....
Iron and steel	119	31	95.4	56.0	93.4	.....
Lumber	91	26	88.1	38.8	93.7	.....
Cement	118	52	90.5	....	94.6	.....

* *Survey of Current Business*, Annual Supplement, 1932 and February, 1933.
† Not precisely comparable with manufactured food products.
‡ Fuel and lighting.

Foodstuffs and textiles declined comparatively little in production while the production of postponable, durable items suffered a very sharp curtailment, as one would expect from a study of family budgets. And these changes had a profound effect on profits earned. Sharp as were the changes in profits the necessities changed less, on the whole, than the postponable goods industries.

TABLE X

PROFITS EARNED IN 1928 AND 1932 BY CERTAIN SELECTED INDUSTRIES*

Industries	Profits earned† (thousands of dollars) (D)=deficit		Number of companies	
	1928	1932	1928	1932
Necessary goods				
Apparel	20,450	7,818 (D)	24	23
Cotton mills	9,563	9,165 (D)	39	33
Textile products miscellaneous	16,672	9,422 (D)	16	22
Drugs and sundries	55,595	27,704	18	14
Bakery	46,251	27,160	16	17
Food products miscellaneous	102,189	32,217	25	35
Meat packing	39,206	2,029 (D)	20	18
Coal mining	8,081	374	11	10
Postponable goods				
Amusements	38,135	11,346 (D)	13	12
Automobiles	395,005	7,331 (D)	23	12
Building materials	33,729	11,525 (D)	31	32
Electrical equipment	133,308	18,148 (D)	36	24
Household goods‡	81,296	8,051	33	16
Iron and steel	224,392	127,194 (D)	43	33
Heating and plumbing	38,391	1,815 (D)	19	12

* Monthly Letter, National City Bank, issues March, 1930, and 1933.
† The figures here used may not be comparable, their use is merely for illustrative purposes.
‡ In 1928 this is listed as Household Supplies consequently this item may belong in the group of necessary goods.

Can family incomes be brought back to at least the size or purchasing power of 1928? Unless they can the industries producing luxuries and durable goods which share in the dollars expended for the miscellaneous items face, in the future, very lean business, and price rather than advertised quality will continue to rule the roost. Even the incomes of the era prior to 1930 were for most families nothing to brag about. Then nearly 23,000,000 families had incomes of $3,000 a year or less. What all families can use in the way of incomes, with a little training, is indicated by the annual expenditures of our so-called wealthy families.

There has come to be a general recognition among intelligent persons that this country will not again know prosperity unless the purchasing power of our mass of people is increased very materially. The era prior to 1930 demonstrated that we can produce sufficient goods and services to make possible high real incomes for all those willing to work for them. The trouble has been, in large measure, it would seem, a failure to develop and make known a method of distributing wealth that keeps pace with the greatly increased production of which we have become capable. As soon as there is general knowledge of such a method it will, probably, be put into action, not only because the mass of people presses for it, but because many owners of wealth are likely to favor it; we prefer prosperity to depression. There are no natural laws or conditions governing income distribution; it is a man-made division of our

income subject to change whenever man so wishes. The best of our wealthy persons and business men realize they are only trustees for the common good of the wealth which they possess. They realize too, that the effect of low family incomes is just as devastating to business men and the owners of wealth from which income is expected as it is to the bulk of our families. One can believe that many think it is better to share the income more equitably voluntarily than to have this forced unenjoyable sharing and general curtailment of income every few years; that such voluntary sharing might well lead to a steady yearly increase in national and individual incomes.

We can see the effects of changed family incomes on business, but perhaps not so readily on the state. It is not the purpose of this article to point this out, although it might be suggested, in passing, that the lowered incomes have resulted in an enlarged charity list, and this ordinarily, when long continued, breaks down individual morale, and may mean having added materially to our permanent poor relief recipients, which is not particularly good for us.

One can hardly believe that either business men in large numbers, or society in general desire to see incomes such as those of 1932, and one can easily believe that if such incomes long continue, one day an upheaval will occur accompanied by disaster and chaos, which will be devastating to our civilization. Indeed, the general acquiescence in the criticism of capitalism and the more widespread acceptance of the implications inherent in the terms socialism and communism, suggest we may not be so very far away from drastic changes in the accepted institutions of our economic system.

SECONDARY CURVES AS A MEASURE OF THE LAG OR PHASE DIFFERENCE BETWEEN TWO PRIMARY CURVES

By R. von Huhn

PART I. A COMPARISON BETWEEN TYPICAL PRIMARY CURVES AND THEIR RESPECTIVE SECONDARY CURVES

Whenever we have two or more numerical series which show the characteristics of periodic phenomena such as the propagation of sound waves, we frequently find that two points of the same y-magnitude are displaced by a certain x-magnitude on the time axis or, to put it the other way, it occurs that a certain point P_1 of a curve, for example, will be so many time units in advance of a point P_2 of another curve, or vice versa P_1 may follow point P_2. The physicist calls this phenomenon the "phase difference" while the economist terms it the lag. Periodic economic series, however, do not move with the mathematical precision observed in the field of physics and therefore the lag between two series cannot be determined as conveniently and directly as in the case of harmonic amplitudes.

The approach, however, can be made indirectly by means of cumulative curves, which have among other analytic qualities, the unique feature of rectification of primary data, that is to say the secondary curve brings a particular primary curve into a shape which enables the observer to make, through visual conclusions, numerical ones.

We may now proceed with the study of the effect which the cumulative operation has on the non-cumulative data by a comparison between typical primary curves and their respective secondary or cumulative curves. We shall find that each type of primary curve is accompanied by a characteristic secondary curve. In Table I there are shown six types of primary curves P together with their respective secondary curves S. These types of curves are frequently observed when plotting economic series. For better comparison the data for both columns P and S have been reduced to a percentage basis and plotted as shown in Figure I. Now before inspecting these curves we must recall that the line connecting point O with the last y-unit ($x=12$) ($y=100$) represents the average accumulation of the whole period $O-12$, and with reference to this line the various positions of each point on the secondary curve can be measured.

Case 1. The primary curve is bell-shaped [1] and the secondary curve

[1] The term bell-shaped is not used here in the classical sense and, consequently, does not refer to the probability curve.

is *S*-shaped, a characteristic of all bell-shaped curves, having been converted into secondary ones.

Starting from *O* the cumulative rate of increase of the curve falls constantly below the average cumulative rate of increase of the whole period, until at the sixth time unit the cumulative rate of increase of the curve is identical with the average cumulative increase for the whole period at that point. Beyond this point the cumulative rate of the secondary curve is constantly higher than the average cumulative increase and finally at $(x=12)$ $(y=100)$ both rates are the same.

Case 2. The primary curve is *U*-shaped and the secondary curve takes the reversed aspect of Case 1.

Case 3. The primary curve is asymmetrically bell-shaped, the secondary curve takes the shape of a distorted *S*. In this case the cumulative rate of increase of the secondary curve deviates negatively from the average cumulative rate of increase for a short time and after reaching point 1.5 of the time axis the cumulative rate of the secondary curve exceeds the average cumulative rate constantly and finally at $x=12$ both rates are the same.

Case 4. The primary curve is asymmetrical bell-shaped and its skewness negative. The secondary curve takes the reversed aspect of Case 3.

Case 5. The primary curve is *M*-shaped and represents a combination of two bell-shaped curves. We observe two characteristic *S*-shapes in the secondary curve. Closer examination reveals that the first part of the primary curve is similar to Case 3 and the second part of the primary curve similar to Case 4. The secondary curve shows clearly the resemblance to the secondary curve of Case 3 for the first part up to *A* and from there on the resemblance to the secondary curve of Case 4 up to *B*.

Case 6. The primary curve is *W*-shaped and therefore the reversal of the *M*-shaped curve and, consequently, the secondary curve takes the reversed aspect of Case 6.

PART II. ELEMENTARY CHARACTERISTICS OF A SECONDARY CURVE

In Part I we have shown a comparison between non-cumulative and cumulative data of six typical curves by means of general graphic presentation. Before proceeding further in the analysis it will be helpful to consider the relationship of two primary curves P_1 and P_2 as shown in Figure II. From inspection it will be noted that the curve P_1 reaches a maximum and declines thereafter, whereas P_2 also reaches a maximum, but somewhat later. It is evident that the two curves have a degree of displacement or lag with respect to each other, but

FIGURE I

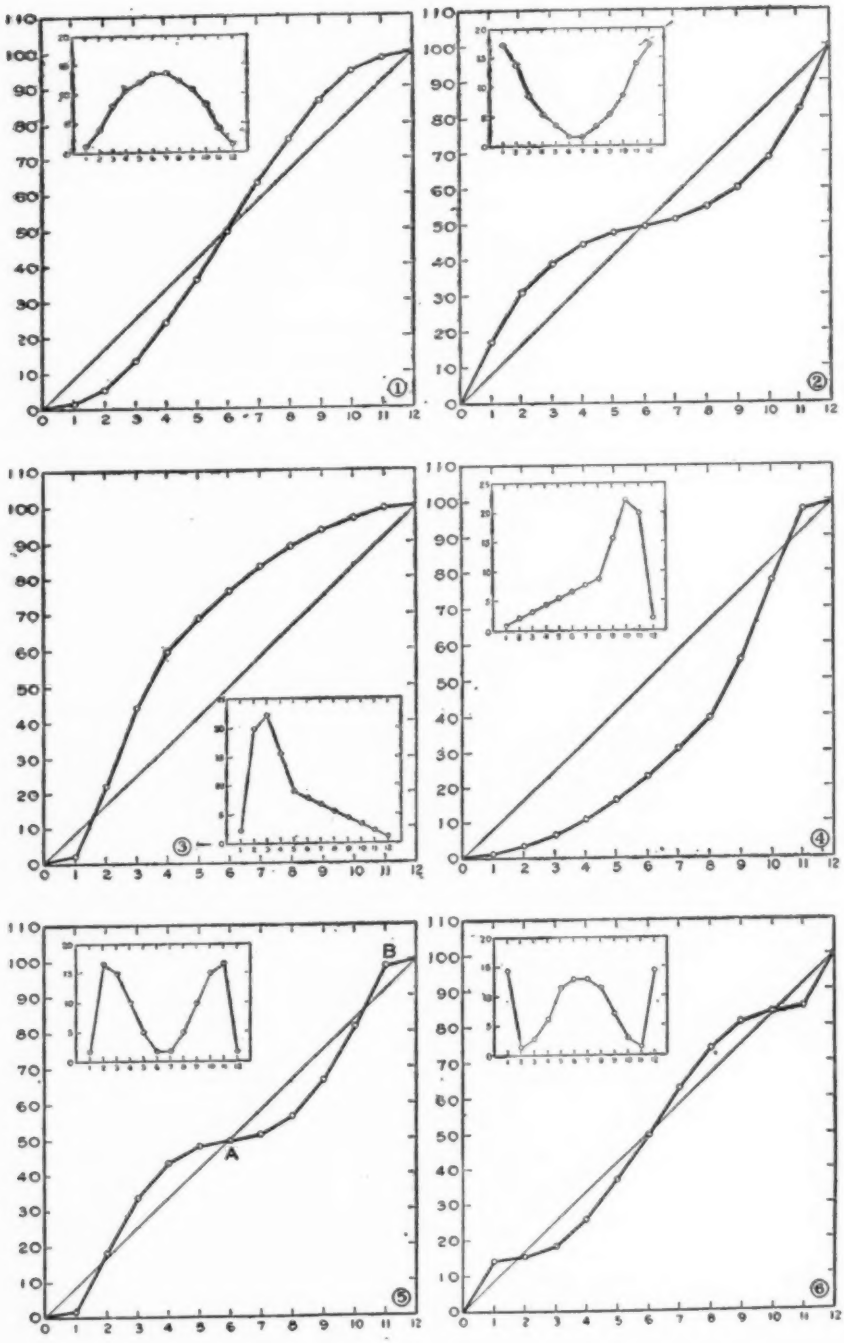


Figure II gives little information as to the magnitude of the lag or phase difference.

We have noted before that the secondary or cumulative operation consists in taking various y-magnitudes of the primary curve (y_{I}; y_{II}; y_{III}; etc.) which are plotted with respect to time beginning with the

TABLE I

X	No. 1		No. 2		No. 3		No. 4		No. 5		No. 6	
	P	*S*	*P*	*S*	*P*	*S*	*P*	*S*	*P*	*S*	*P*	*S*
1	10	10	100	100	10	10	5	5	10	10	100	100
2	30	40	80	180	90	100	10	15	100	110	10	110
3	60	100	50	230	100	200	15	30	90	200	20	130
4	80	180	30	260	70	270	20	50	60	260	50	180
5	90	270	20	280	40	310	25	75	30	290	80	260
6	100	370	10	290	35	345	30	105	10	300	90	350
7	100	470	10	300	30	375	35	140	10	310	90	440
8	90	560	20	320	25	400	40	180	30	340	80	520
9	80	640	30	350	20	420	70	250	60	400	50	570
10	60	700	50	400	15	435	100	350	90	490	20	590
11	30	730	80	480	10	445	90	440	100	590	10	600
12	10	740	100	580	5	450	10	450	10	600	100	700

TABLE Ia

X	No. 1		No. 2		No. 3		No. 4		No. 5		No. 6	
	P	*S*	*P*	*S*	*P*	*S*	*P*	*S*	*P*	*S*	*P*	*S*
1	1.35	1.35	17.24	17.24	2.22	2.22	1.11	1.11	1.66	1.66	14.29	14.29
2	4.05	5.40	13.79	31.03	19.99	22.21	2.22	3.33	16.66	18.32	1.43	15.72
3	8.11	13.51	8.62	39.65	22.22	44.43	3.33	6.66	14.99	33.31	2.85	18.57
4	10.81	24.32	5.17	44.82	15.55	59.98	4.44	11.10	9.99	43.30	7.14	25.71
5	12.16	36.48	3.45	48.27	8.88	68.86	5.55	16.65	4.99	48.29	11.43	37.14
6	13.51	49.99	1.72	49.99	7.77	76.63	6.66	23.31	1.66	49.95	12.86	50.00
7	13.51	63.50	1.72	51.71	6.66	83.29	7.77	31.08	1.66	51.61	12.86	62.86
8	12.16	75.66	3.45	55.16	5.55	88.84	8.88	39.96	4.99	56.60	11.43	74.29
9	10.81	86.47	5.17	60.33	4.44	93.28	15.55	55.51	9.99	66.59	7.14	81.43
10	8.11	94.58	8.62	68.95	3.33	96.61	22.22	77.73	14.99	81.58	2.85	84.28
11	4.05	98.63	13.79	82.74	2.22	98.83	19.99	97.72	16.66	98.24	1.43	85.71
12	1.35	99.98	17.24	99.98	1.11	99.94	2.22	99.94	1.66	99.90	14.29	100.00

first one and adding to it the next one in sequence, then taking a subtotal and so on until the last value of the series has been reached. Expressed in symbols this would mean:

$y_{\text{I}} = y_1 = P_1 =$ First point on the secondary curve

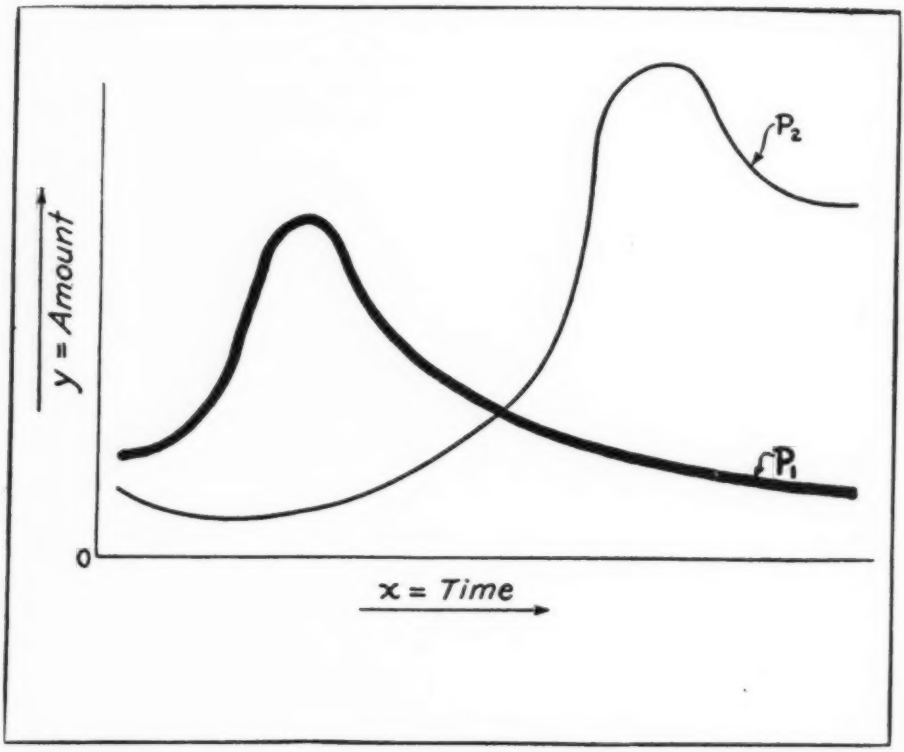
$y_{\text{I}} + y_{\text{II}} = y_2 = P_2 =$ Second point on the secondary curve

$y_{\text{I}} + y_{\text{II}} + y_{\text{III}} = y_3 = P_3 =$ Third point on the secondary curve

Hence, P_1; P_2; P_3 represent cumulative totals up to a given point on the secondary curve Figure III, hence,

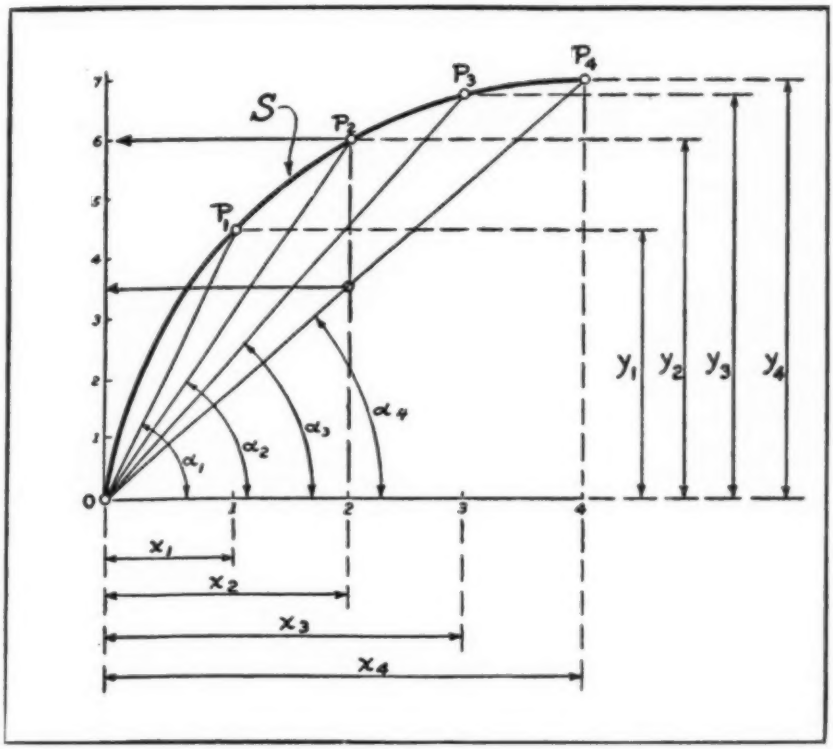
$$\frac{y_1}{x_1}; \frac{y_2}{x_2}; \frac{y_3}{x_3}$$

FIGURE II



represent cumulative average rates of increase at points P_1; P_2; P_3, respectively. At this point it will be helpful to consider by means of a simple example the mathematical characteristics of the cumulative method. Let us assume that curve S in Figure III represents a secondary curve and that P_1; P_2; P_3 and P_4 represent points on the curve for x_1; x_2; x_3 and x_4, respectively. If we connect point O successively with point P_1; P_2; P_3 and P_4, it is evident that for each of these points the average rate of increase varies according to the magnitude of the angles α_1; α_2; α_3 and α_4 and as the slopes of these angles decrease the various cumulative rates measured at the respective points on curve S also decrease. It is furthermore evident that the average rate for the total period $x_4=4$, is $7\div4=1.75$ which is equivalent to the tangent function of α_4 and from this it follows that for the remaining points the other angles α_1; α_2; α_3 are greater, thereby indicating a greater average increase for these particular points. Consequently, if the other average rates for various points of the curve S were greater than the final

FIGURE III



one represented by α_4 it is evident that the actual increases must have become smaller in order to reach eventually point P_4. This can be verified from Figure III. For example, at point $P_2(x_2)$, the line $\overline{OP_2}$ representing the cumulative average rate for P_2 at $x=2$ has reached point 6 on the vertical scale whereas the average rate for the whole period at $x=2$ has reached 3.4 units. As the curve advances to point P_3 the difference between these two magnitudes becomes smaller until in P_4 it becomes zero.

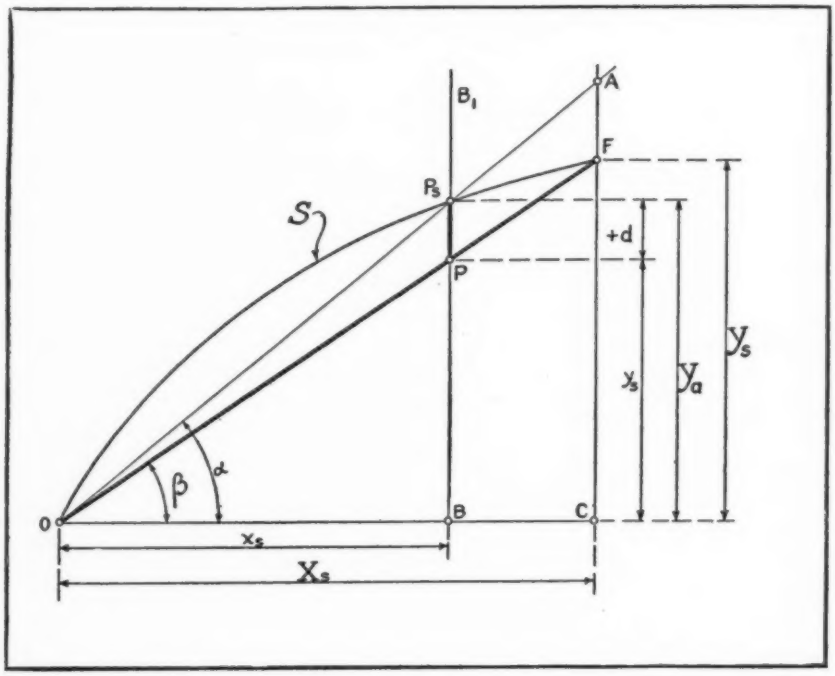
PART III. THE CUMULATIVE VERTICAL DISPLACEMENT FOR A GIVEN POINT P_s ON A CUMULATIVE CURVE AS COMPARED WITH THE AVERAGE VERTICAL DISPLACEMENT FOR THE WHOLE PERIOD

In Chart IV, S represents a cumulative curve and P_s represents a point on the curve at the arbitrary time unit x_s on the time axis, the vertical line $\overline{B_1B}$ representing a section through the time axis. Now the slope of the line $\overline{OF}$ is proportional to the average cumulative rate

for the whole period X_s which equals tangent β, on the other hand the slope of the line $\overline{OP_s}$ represents the average cumulative increase of the curve S up to the given point P_s, which equals tangent α. If we use the line $\overline{OF}$ as a base for measuring the respective deviations of curve S from $\overline{OF}$ we observe that at the intersection $\overline{BB_1}$, $\overline{P_sP}$ equals d which represents the positive deviation of S from the line $\overline{OF}$ at the given intersection BB_1 and therefore it follows:

P_s in precession[1] of P

FIGURE IV



$\angle\beta$ smaller than $\angle\alpha$
y_s smaller than Y_a
$\overline{P_sP} = d$ (positive)
$\overline{CA}: X_s = Y_a : x_s$

therefore: $$Y_a = \frac{\overline{CA}.x_s}{X_s}$$

[1] The terms "precession" or "succession" in the case of Figures IV and V refer to the *vertical* excess or deficiency $(\overline{P_sP}) = +d$ of the actual accumulation (S-curve) at a given time element, say x_s, as measured from the line $(\overline{O\,F})$, which represents the average accumulation for the whole period. The terms therefore relate to the difference $(\overline{P_sP})$ between actual accumulation and average accumulation for the same time element x_s.

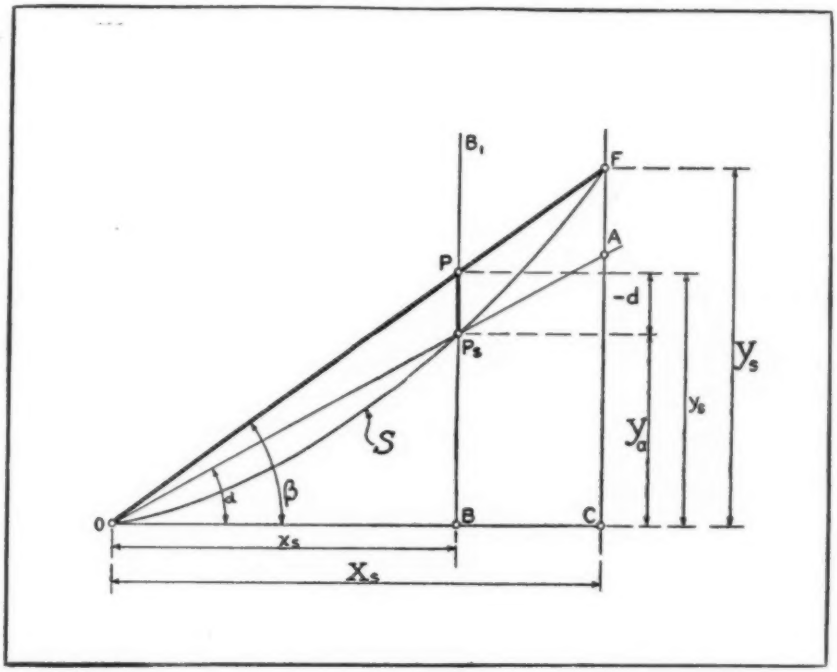
furthermore: $(Y_a - y_s) = d$ (d is positive with respect to OF)

hence, $$+d = \frac{\overline{CA}.x_s}{X_s} - y_s$$

In Figure V we observe that at the intersection $\overline{B_1B}$ the point P_s on the curve S deviates from $\overline{OF}$ negatively by the linear amount $\overline{PP_s} = -d$ and therefore it follows:

P_s in succession of P
$\angle\beta$ greater than $\angle\alpha$
y_s greater than Y_a
$\overline{P_sP} = d$ = negative
$\overline{CA}: X_s = Y_a : x_s$

FIGURE V



therefore: $$Y_a = \frac{\overline{CA}.x_s}{X_s}$$

furthermore: $(y_s - Y_a) = d$ (d is negative with respect to OF)

hence, $$-d = y_s - \frac{\overline{CA}.x_s}{X_s}$$

Example (I) $\angle\beta$ smaller than $\angle\alpha$; d positive
given: $y_s=14$; $\overline{CA}=69$; $X_s=100$; $x_s=40$

$$d=\frac{\overline{CA}.x_s}{X_s}-y_s=\frac{69\times40}{100}-14=27.60-14$$

$d=13.60$ (positive)

Example (II) $\angle\beta$ greater than $\angle\alpha$; d negative
given: $y_s=65$; $\overline{CA}=69$; $X_s=100$; $x_s=71$

$$d=y_s-\frac{\overline{CA}.x_s}{X_s}=65-\frac{69\times71}{100}=65-48.99$$

$d=16.01$ (negative)

Trigonometric Equations for $+d$ and $-d$

(*a*) *Case No. 1* $\angle\beta$ smaller than $\angle\alpha$

$$\text{tang } \alpha=\frac{Y_a}{x_s}$$

$$\text{tang } \beta=\frac{y_s}{x_s}$$

it follows therefore:

$$Y_a=(\text{tang } \alpha.x_s)$$
$$y_s=(\text{tang } \beta.x_s)$$

furthermore:

$$d=(Y_a-y_s)=(\text{tang } \alpha.x_s)-(\text{tang } \beta.x_s)$$
$$d \text{ (positive)}=x_s\ (\text{tang } \alpha-\text{tang } \beta)$$

(*b*) *Case No. 2* $\angle\beta$ greater than $\angle\alpha$

$$\text{tang } \alpha=\frac{Y_a}{x_s}$$

$$\text{tang } \beta=\frac{y_s}{x_s}$$

it follows therefore:

$$y_s=(\text{tang } \beta.x_s)$$
$$Y_a=(\text{tang } \alpha.x_s)$$

furthermore:

$$d=(y_s-Y_a)=(\text{tang } \beta.x_s)-(\text{tang } \alpha.x_s)$$
$$d \text{ (negative)}=x_s\ (\text{tang } \beta-\text{tang } \alpha)$$

PART IV. THE CUMULATIVE HORIZONTAL DISPLACEMENT FOR A GIVEN POINT P_s ON A CUMULATIVE CURVE S AS COMPARED WITH THE AVERAGE CUMULATIVE DISPLACEMENT AT THIS POINT

In Figure VI, S represents a cumulative curve and P_s a given point on the curve at the arbitrary time unit x_s on the time axis, the vertical line $\overline{B_1B}$ representing a section through the time axis. The slopes of $\overline{OF}$ and $\overline{OA}$ are proportionate to the tangents of angle β and α respectively. Now a horizontal line put through point P_s parallel to the x-axis intersects $\overline{OF}$ in N and consequently it follows:

P_s in precession [1] of P

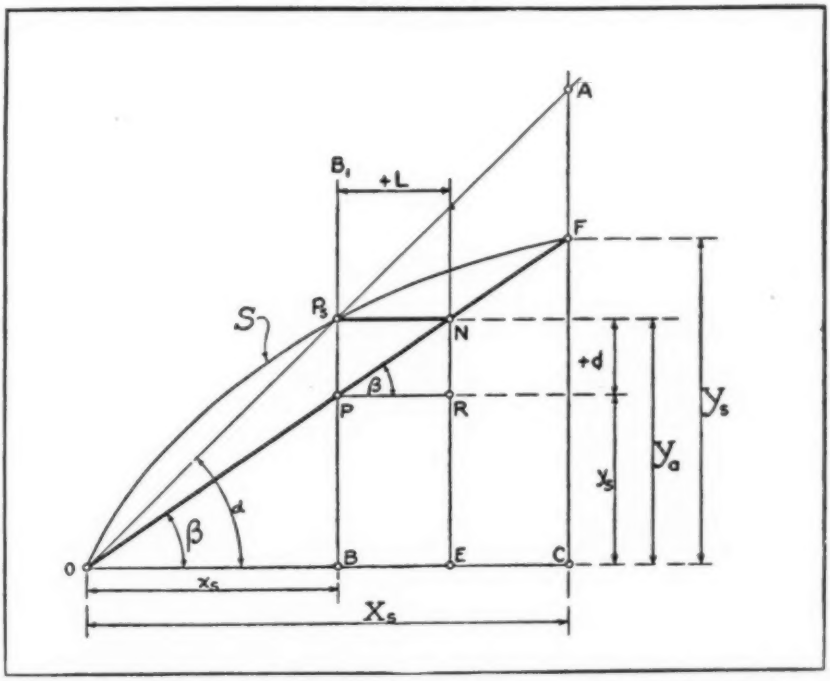
$\angle\beta$ smaller than $\angle\alpha$

y_s = smaller than Y_a

$\overline{P_sP} = d$ (positive)

$$\text{tang } \alpha = \frac{Y_a}{x_s}$$

FIGURE VI



[1] The terms "precession" or "succession" in the case of Figures VI and VII refer to the *horizontal* excess or deficiency $(\overline{P_sN}) = \mp L$ as measured by any line parallel to the time axis, which intersects the S-curve and the line $(\overline{OF})$ respectively. The terms therefore relate to the difference $(\overline{P_sN})$ between the actual time x_s and the average time $\overline{OE}$ needed for the same accumulation namely, $\overline{BP_s}$ and $\overline{EN}$ respectively.

$$\text{tang } \beta = \frac{y_s}{x_s}$$

$$(Y_a - y_s) = \overline{P_s P} = d$$

$$\text{tang } \beta = \frac{d}{P_s N}$$

$$\overline{P_s N} = L = \frac{d}{\text{tang } \beta}$$

$$L = \overline{P_s N} = \frac{Y_a - y_s}{\frac{y_s}{x_s}}$$

$$L = \frac{(Y_a - y_s)}{y_s} . x_s$$

$$L = (Y_a - y_s).\text{cotg } \beta \text{ or } L = x_s \left(\frac{\text{tang } \alpha}{\text{tang } \beta} - 1 \right)$$

Comparison is made between the average rate of the point P_s ($\angle \alpha$) on curve S at the time element x_s (intersection $\overline{B_1 B}$) and the average cumulative rate of point P_s ($\angle \beta$) which is represented by P. If P_s had moved at the average constant rate according to the slope of angle β it would have reached the magnitude of $\overline{P_s B} = Y_a$ later to the extent of $\overline{P_s N} = L$ and therefore the length of L in the diagram equals the amount of time which P_s moves in precession of its own cumulative rate for the whole period at the intersection $\overline{B_1 B}$.

In Figure VII, S represents again a cumulative curve and P_s a point on the curve as shown in Figure VI, the only difference being that in this case point P_s moves in sequence as compared with point N and consequently it follows:

P_s in sequence of P
$\angle \beta$ greater than $\angle \alpha$
y_s greater than Y_a
$\overline{P_s P} = d$ (negative)

$$\text{tang } \alpha = \frac{Y_a}{x_s}$$

$$\text{tang } \beta = \frac{y_s}{x_s}$$

$$(y_s - Y_a) = \overline{P P_s} = d$$

$$\text{tang } \beta = \frac{d}{N P_s}$$

$$\overline{NP_s} = L = \frac{d}{\text{tang } \beta}$$

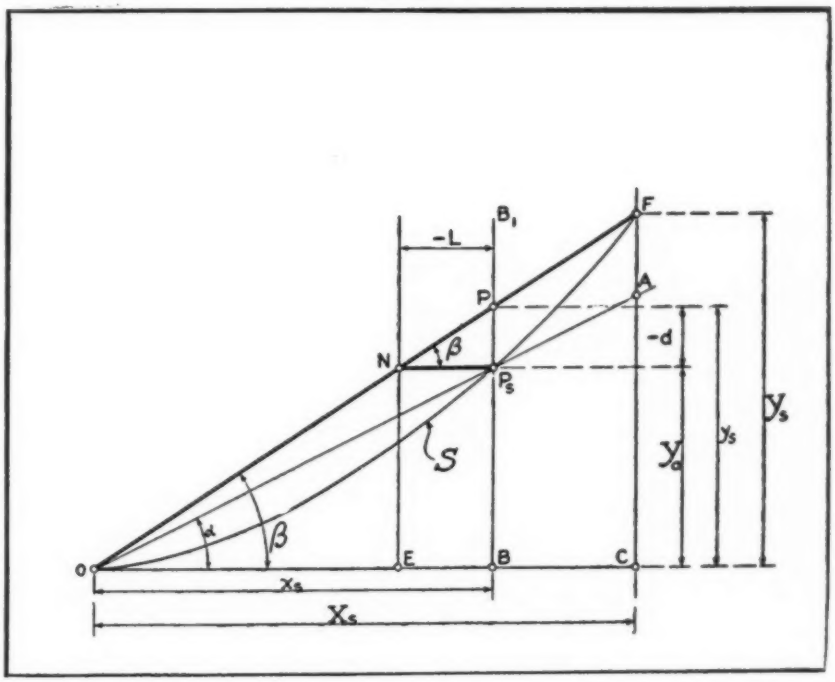
$$L = \overline{NP_s} = \frac{y_s - Y_a}{\frac{y_s}{x_s}}$$

$$L = \frac{(y_s - Y_a).x_s}{y_s}$$

$$L = (y_s - Y_a)\text{cotg } \beta \text{ or } L = x_s\left(1 - \frac{\text{tang } \alpha}{\text{tang } \beta}\right)$$

Comparison is made between the average rate of a point P_s ($\angle \alpha$) on curve S at the time element x_s at intersection $\overline{B_1B}$ and the average cumulative rate of point P_s($\angle \beta$) which is represented by P at the intersection B_1B. If point P_s had moved at the average constant rate proportional to the slope of $\angle \beta$ it would have reached the magnitude of $\overline{P_sB} = Y_a$ earlier to the extent of $\overline{P_sN} = L$ and therefore L equals the amount of time which P_s moves in succession of its own cumulative rate for the whole period at the intersection $\overline{B_1B}$ at x_s.

FIGURE VII



From the discussion it follows that we are able to compute the lag of a curve with respect to its own average rate for a given point P_s on the curve when x_s, $\angle\alpha$ and $\angle\beta$ are given.

Case 1: d is positive; $\overline{P_sN}=L$
therefore

$$L=x_s\left(\frac{\text{tang }\alpha}{\text{tang }\beta}-1\right)$$

Example: $x_s=49$ units; $\alpha=44°\ 40'$; $\beta=34°\ 20'$
tang $\alpha=.988$; tang $\beta=.683$

Substituted in above formula we obtain:

$$L=49(1.446-1)$$
$$L=22.83 \text{ time units } (P_s \text{ in precession})$$

Case 2: d is negative; $\overline{P_sN}=L$
therefore

$$L=x_s\left(1-\frac{\text{tang }\alpha}{\text{tang }\beta}\right)$$

Example: $x_s=78$ units; $\alpha=26°\ 35'$; $\beta=33°\ 10'$
tang $\alpha=.500$; tang $\beta=.653$

Substituted in above formula we obtain:

$$L=78(1-.764)$$
$$L=18.41 \text{ time units } (P_s \text{ in succession})$$

PART V. THE COMPUTATION OF THE LAG BETWEEN TWO SECONDARY CURVES

Now in order to obtain a measure of the lag between two curves we shall find it convenient to express the various subtotals of each secondary curve as percentages of their respective totals, similar to the cumulative frequencies necessary to compute an ogive. Consequently the totals of both curves will equal 100 per cent and the connecting line between zero and the 100 per cent point represents the average per cent accumulation. Here it is well to point out that there is no absolute measure for the lag between two irregular curves because the magnitude of the lag depends upon the selection of the point of reference and therefore we must assume this reference or base at the outset. In the following we shall measure the lag relative to the following references: (1) the lag of two curves computed in relation to the average per cent line, (2) the lag computed in relation of one curve to another, (3) the lag computed on the basis of a given percentage accumulation.

We shall find that each of these methods will yield a different type of lag and the three above mentioned ones do not exhaust other possibilities. Furthermore, it will be convenient to plot the various curves and determine the various phase differences graphically.

Case 1

In Figure VIII there are shown the secondary curves Nos. 1 and 3 converted to a per cent basis (see Figure I). The arbitrary intersection $y-y$ on the time axis x, intersects the average percentage line $\overline{OH}$ at C, therefore the distance $\overline{AC}$ represents the magnitude of the time element which curve No. 3 runs in precession of the average per cent line at the eighth time unit and consequently, $\overline{BC}$ represents the time units which curve No. 1 runs in precession of the average per cent line $\overline{OH}$ at the same intersection.

In Figure IX these values have been plotted accordingly. We observe that part of the time both curves lag behind the constant rate line, curve No. 3 crosses the line at K overtaking at this point its own average rate and curve No. 1 later at point M, hereafter both curves run in precession of their respective constant rates. Figure IX can be interpreted that at the intersection $y-y$ at point 8 on the x-axis, curve No. 3 has reached point A, 3.3 time-units (measured from graph) sooner than it would have reached the same magnitude (point C on line $\overline{OH}$) had it progressed at the constant rate, and in the case of curve No. 1 point B was reached .8 time-units sooner respectively.

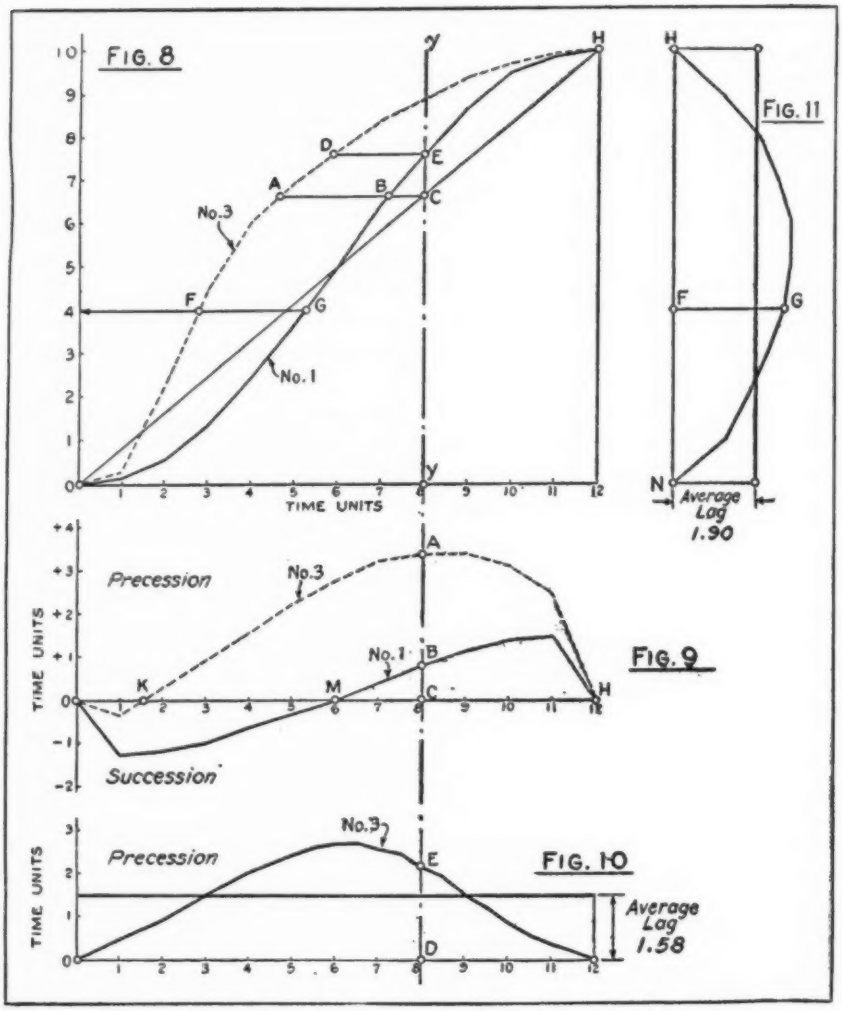
Case 2

Again in Figure VIII measurements are made between curve Nos. 3 and 1, using the latter one as reference. The vertical line $y-y$ at point 8 on the time axis intersects curve No. 1 at E. Now if a line is drawn through E parallel to the x-axis it intersects curve No. 3 in D. The distance $\overline{ED}$ represents a measure of the lag between curves No. 3 and 1. In Figure X these magnitudes have been plotted accordingly and show that curve No. 3 is constantly in precession of curve No. 1 when measured from curve No. 1 as reference line.

Case 3

When using this measure of displacement as shown in Figures VIII and XI the lag is measured in terms of percentage accumulation, that is to say, for example, that when each curve has reached 40 per cent of its own "performance" the relative displacement of curve No. 3 with respect to curve No. 1 is represented by the line $\overline{FG}=2.5$ time units (measured from graph) and represents the amount of precession, which curve No. 3 has as compared with curve No. 1 at 40 per cent of their respective accumulation.

FIGURES VIII, IX, X AND XI



PART VI. THE AVERAGE LAG

In the preceding paragraphs we have measured the relative lag between two curves at a given section of the time axis x. We now come to the measurement of the average lag for the total period. For this purpose we shall find Case 2 and 3 most suitable. It is only necessary to compute with the aid of a planimeter [1] the area between curve No.

[1] In case a planimeter is not available there are two methods by which an area can be computed without it. In case of the first method it is only necessary to plot the respective curves on millimeter paper and carefully cut out that part of the area which is to be computed, to determine its weight and to compare

3 and No. 1 in Figure VIII. This area measures approximately 19 square units. If we divide 19 square units by the base line 12 linear units in Figure X, we obtain the average lag 1.58 time units, and dividing 19 square units by 10 in the case of Figure XI, we obtain the average lag 1.9 time units. In the first case this means that the amount of succession of curve 3 as compared with curve 1 amounted to 1.58 time units and in the second case the lag of 1.9 time units must be interpreted to mean that on the average for equal percentages of performance of the two curves, curve No. 3 lagged 1.9 time units as compared with No. 1.

BIBLIOGRAPHICAL REFERENCES

T. H. Brown, R. F. Bingham, V. A. Temnomeroff, *Laboratory Handbook of Statistical Methods*, Boston, 1930, Harvard University, page 178.

Robert Emmet Chaddock, *Principles and Methods of Statistics*, New York, 1925, Houghton Mifflin Company, pages 118, 119.

George A. Gibson, *An Elementary Treatise on Graphs*, London, 1913, Macmillan and Company, pages 158, 203.

R. von Huhn—

"Graphical Analysis of an Overtime Problem," *Industrial Management*, February, 1919;

"A New Graphical Method for Comparing Performance with Program or Expectation," *Science*, June 28, 1918, N. S. Vol. XLVII, No. 1226, page 642.

Karl G. Karsten—

"The Theory of Quadrature in Economics," this JOURNAL, March, 1924, Vol. XIX, No. 145, pages 15–29.

"The Harvard Business Indexes—A New Interpretation," this JOURNAL, December, 1926, Vol. XXI, No. 156, pages 399–418.

Frederick C. Mills, *Statistical Methods*, Henry Holt and Company, New York, 1924, pages 46, 88, 90.

Raymond Pearl, *Introduction to Medical Biometry and Statistics*, Philadelphia and London, 1930, W. B. Saunders and Company, pages 179–180.

O. Prölss, *Graphisches Rechnen*, B. G. Teubner, Leipzig, Berlin, page 92.

C. Runge, *Graphische Methoden*, B. G. Teubner, Leipzig, Berlin, page 87.

---

it in turn with the weight of a known area of the same stock of paper. A chemical balance can be used to advantage.

The second method represents an approximation. The *S*-values in Table Ia are added for curves No. 1 and 3 respectively and the total subtracted from each other. In the above example we obtain 835.12 − 649.87 = 18.52 square units. The planimeter measures this area to be 19.00 square units and therefore the error amounts to about 2.5 per cent.

NOTES

ADJUSTING FOR THE CHANGING DATE OF EASTER IN ECONOMIC SERIES

By Jeanette Homan, *Western Electric Company*

In comparing the statistics for any month with those for the previous month, it is customary for the statistician to adjust the data for seasonal variation. In comparing with the corresponding month of the previous year, however, usually no such adjustment is needed. In several series of data followed currently by economists and statisticians, however, the occurrence of Easter has a direct effect upon the results for the months of March and April. In these series, therefore, to make a correct year-to-year comparison, the data should be adjusted for the effect of the different dates on which Easter occurs in the two years. For example, the daily average chain store sales in March, 1933, was 20 per cent smaller than in March, 1932. In 1932, however, Easter occurred on March 27th, so that the results for the month of March, 1932, contained the full effect of Easter purchasing. In 1933, Easter came on April 16th. If we adjust the sales figures for the effect of the different date of Easter, we find that the level of March, 1933, sales was only 11 per cent under March, 1932.[1]

In attempting to compute the effect of Easter upon series of data, we are confronted with the fact that most consistent series do not cover a long enough range of years to afford many instances in which Easter occurs on the same date. Some headway can be made, however, by working with the trend of the effect of the changes from the earliest to the latest date on which Easter may fall. By plotting a curve running from March 27th to April 20th, the usual range of the Easter dates, it is possible to find a trend which will represent the effect of these changing dates on the series studied. This can be further refined by being tied in with a constant, as will be illustrated in this study.

An analysis of the series for chain store sales explains and illustrates a method which seems both simple and effective for adjusting for Easter in the index of seasonal variation. The basic data used in this study are the monthly totals of sales of the four chain stores: F. W. Woolworth, S. S. Kresge, McCrory Stores Corporation, and S. H. Kress and Company, from 1919 to date, as given in the *Survey of*

[1] The writer recognizes that the idea of adjusting for the date of Easter is not new. The December, 1927, issue of this Journal carried a note on the Federal Reserve Board's Easter adjustment for department store sales. It is surprising to note, however, that in computing their year-to-year percentages for March and April, no Easter adjustment is used.

Current Business. The first step in the analysis is to adjust for the changing number of working days in the different months, by dividing each monthly total by the number of working days in the month. This gives a series showing daily average sales for each month. The number of days used for this adjustment is the six working days of the week, excluding legal holidays, and considering Saturday as one and one-third days. The link relatives of these daily averages are next computed, as is also the $\frac{\text{May}}{\text{February}}$ relative for each year.

Since both March and April are affected directly by the date on which Easter occurs, the March, April, and May link relatives are accordingly affected. The relative, $\frac{\text{May}}{\text{February}}$, however, should not be affected. This relative is the product of the March, April, and May link relatives.

$$\frac{\text{March}}{\text{February}} \times \frac{\text{April}}{\text{March}} \times \frac{\text{May}}{\text{April}} = \frac{\text{May}}{\text{February}}.$$

Since $\frac{\text{May}}{\text{February}}$ is not influenced by the date of Easter, we can use it to check and balance the three changing links which have been computed for March, April, and May.

The average link relative for each month has been computed from the actual relatives from February, 1919, through January, 1933. The type of average used in a study depends, of course, somewhat upon the data in hand. The averages as herein computed are broadened medians—the averages of the mid-four relatives for the fourteen years, arranged in order of magnitude, the five highest and the five lowest items being eliminated. The average link relatives for March, April, and May are not computed, but the average $\frac{\text{May}}{\text{February}}$ relative is included. Table I shows these averages together with the computation columns *B*, *C*, and *D* according to the Person link-relative method for computing indices of seasonal variation.

Since the $\frac{\text{May}}{\text{February}}$ relative is the product of the February, March, and April link relatives, it can be multiplied by the February chain relative to give the correct May chain relative shown in column B.

The March, April, and May link relatives can now be dealt with separately. The accompanying scatter diagrams show the link relatives for each of these months. Each point is labelled for the year to which it applies, and is plotted according to the date upon which

LINK RELATIVES OF CHAIN STORE SALES
PLOTTED ACCORDING TO DATE OF EASTER

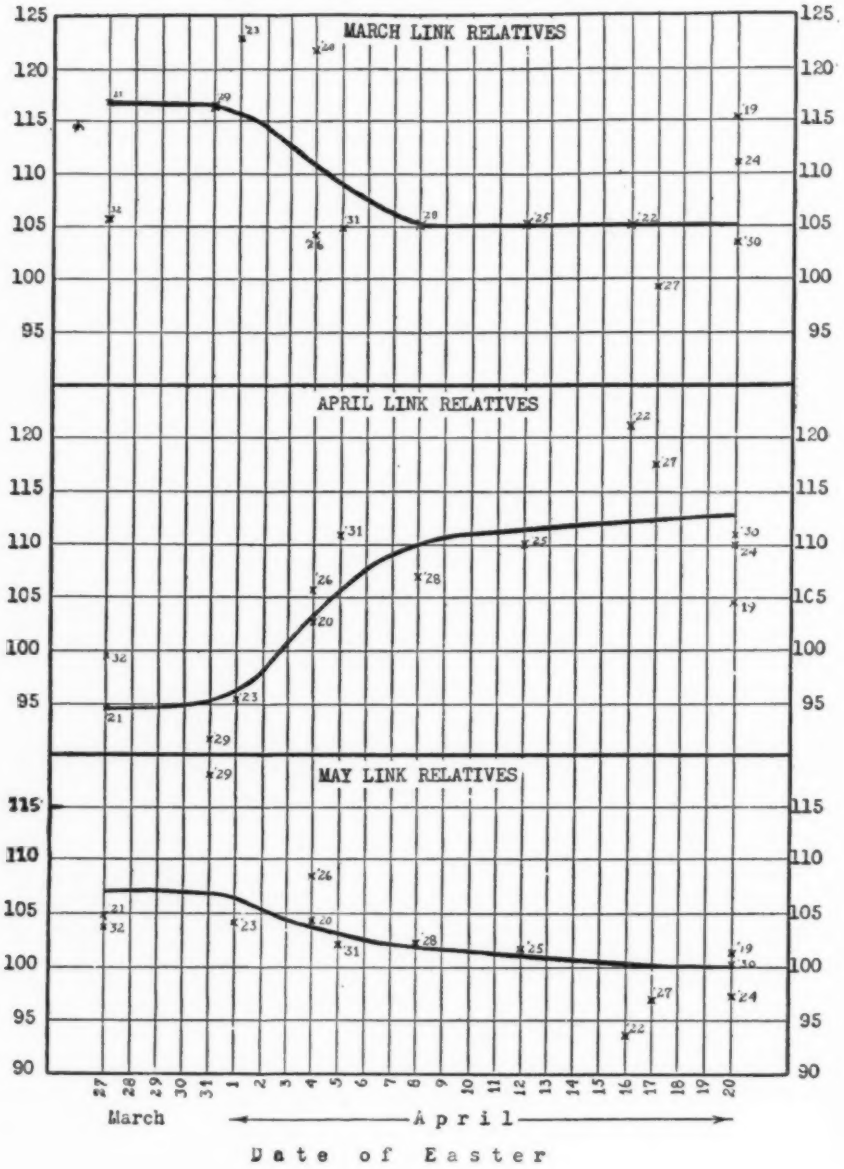


TABLE I

Month	*A* Average link relatives	*B* Chain relatives	*C* Correction divisors	*D* Corrected chain relatives
January	40.4	100.0	1.000	100.0
February	111.2	111.2	1.004	110.8
March	.....	.....	1.007	.....
April	.....	.....	1.011	.....
May	118.6	131.9	1.015	130.0
June	94.7	124.9	1.019	122.6
July	97.9	122.3	1.022	119.7
August	100.8	123.3	1.026	120.2
September	105.5	130.1	1.030	126.3
October	110.0	143.1	1.034	138.4
November	102.1	146.1	1.037	140.9
December	177.0	258.6	1.041	248.4
January	40.4	104.5	1.045	100.0

Easter fell in that year. As would be expected, the earlier the date of Easter, the higher the link relative for March, and the lower that for April, and (since May sales are not affected) the higher the link relative for May. A smoothed curve has been drawn on the diagrams representing what seems a reasonable trend of the actual relatives. This curve can be drawn free-hand, and even the first try, if carefully done, can give fairly good results.

Table I gives 118.6 as the average $\frac{\text{May}}{\text{February}}$ relative—the product of the link relatives for February, March, and April. The product of the corresponding points for each date on these three smoothed curves should, therefore, give this result. Rough first smoothings can, accordingly, be refined by being adjusted to this product. The points on the curves as computed for Chain Store Sales are given in Table II.

Having these results in hand, the proper seasonal indices for any year can be computed by filling in the chain for March and April according to the above relatives for the date upon which Easter falls in that year, and so completing the series for the twelve months.

Table III shows the computation for 1931, 1932, and 1933 when the date of Easter is April 5th, March 27th, and April 16th respectively. The chain series and the correction divisors remain as in Table I. The March, April, and May link relatives when applied to the February chain relative, will, of course, always give the same May chain relative, since this method has so provided.

The difference in the March and April corrected chain relatives makes a difference in the arithmetic average for the different years, but this difference will always be too small to cause a significant difference in the indices of seasonal variation for January and February, and May through December for different years.

TABLE II

	A Date of Easter	*B* March / February	*C* April / March	*D* May / April	*E* May / February $B \times C \times D$
March	27th	116.9	94.7	107.1	118.6
	28th	116.9	94.7	107.1	
	29th	116.9	94.7	107.1	
	30th	116.8	94.9	107.0	
	31st	116.5	95.2	106.9	
April	1st	115.8	96.2	106.5	
	2nd	114.6	98.0	105.6	
	3rd	112.8	100.6	104.5	
	4th	110.7	103.2	103.8	
	5th	108.9	105.5	103.2	
	6th	107.4	107.5	102.7	
	7th	106.3	109.0	102.3	
	8th	105.6	110.1	102.0	
	9th	105.3	110.7	101.7	
	10th	105.1	111.1	101.5	
	11th	105.1	111.4	101.3	
	12th	105.1	111.6	101.1	
	13th	105.1	111.8	100.9	
	14th	105.1	112.0	100.8	
	15th	105.1	112.2	100.6	
	16th	105.1	112.4	100.4	
	17th	105.1	112.6	100.2	
	18th	105.1	112.7	100.1	
	19th	105.1	112.8	100.0	
	20th	105.1	112.8	100.0	

TABLE III

Month	Link relatives			Chain relatives			Corrected chain relatives			Indices of seasonal variation		
	1931	1932	1933	1931	1932	1933	1931	1932	1933	1931	1932	1933
January	.....	.....	.....	.....	.....	.....	100.0	.....	.....	74.8	74.6	74.8
February	.....	.....	.....	111.2	.....	.....	110.8	.....	.....	82.9	82.7	82.9
March	108.9	116.9	105.1	121.1	130.0	116.9	120.3	129.1	116.1	90.0	96.3	86.9
April	105.5	94.7	112.4	127.8	123.1	131.4	126.4	121.8	130.0	94.6	90.9	97.3
May	103.2	107.1	100.4	131.9	131.9	131.9	130.0	.....	.....	97.3	97.0	97.3
June	.....	.....	.....	.....	.....	.....	122.6	.....	.....	91.7	91.5	91.8
July	.....	.....	.....	.....	.....	.....	119.7	.....	.....	89.6	89.3	89.6
August	.....	.....	.....	.....	.....	.....	120.2	.....	.....	89.9	89.7	90.0
September	.....	.....	.....	.....	.....	.....	126.3	.....	.....	94.5	94.2	94.5
October	.....	.....	.....	.....	.....	.....	138.4	.....	.....	103.5	103.3	103.6
November	.....	.....	.....	.....	.....	.....	140.9	.....	.....	105.4	105.1	105.4
December	.....	.....	.....	.....	.....	.....	248.4	.....	.....	185.8	185.4	185.9
Average	.....	.....	.....	.....	.....	.....	133.7	134.0	133.6	100.0	100.0	100.0

The same general principles applied in the above analysis can be applied in connection with other methods than the link relative to compute seasonal indices which will allow for the changing date of Easter. If the thirteen-months-ratio-first-difference method [1] is used, the discrepancy noted in the preceding paragraph will not appear.

[1] This method for computing seasonal variation is described by A. O. Bauman in the September, 1928, issue of this JOURNAL.

COMMITTEE ON GOVERNMENT STATISTICS AND INFORMATION SERVICES

Jointly sponsored by the American Statistical Association and the Social Science Research Council, provided with an appropriation for one year of operation by the Rockefeller Foundation, and with its proffer of "immediate assistance and advice in the reorganization and improvement of the statistical and informational services of the federal government" accepted by the Secretaries of Agriculture, the Interior, Commerce and Labor, this Committee began active work in Washington early in June. It is designed, to an extent consistent with continuity, to be flexible in personnel and program. It is to be represented in Washington at all times with a working quorum of its membership, and with a staff adapted to the problems upon which it may be engaged. The membership during the summer quarter, as jointly designated by Mr. Robert T. Crane on behalf of the Council and Mr. Stuart A. Rice on behalf of the Association, consists of Edmund E. Day, Chairman, Stuart A. Rice, Acting Chairman, Meredith B. Givens, Executive Secretary, Bryce M. Stewart, Morris A. Copeland, Willard L. Thorp and William L. Crum. This personnel is intended to secure representation for the interests not only of the Council and the Association, but as well for the Joint Advisory Committee to the Census of the Statistical and Economic Associations; the Joint Committee on Income Tax Statistics of these Associations and the American Association of University Professors in Accounting; and the Statistical Association's Special Advisory Committee to the Secretary of Labor. Members of the Committee have participated actively in the Committee's enterprise during its initial stages. Other members of the Association who have been engaged on behalf of the Committee in various phases of its work include Woodlief Thomas, Joseph B. Hubbard, Margaret Klem, Jacob Perlman, A. Howard Myers, and Hilding Anderson. The Committee is coöperating closely both with the established statistical agencies of the federal government and with the newer organizations which are being established under the agricultural and industrial recovery programs. It is occupying offices in Room 5519 Commerce Building and Room 716 Labor Building, in Washington.

One of the first activities of the Committee was the preparation of an extensive memorandum addressed to Honorable John Dickinson, Assistant Secretary of Commerce, and to Dr. Alexander Sachs, Chief, Division of Research and Planning, Industrial Recovery Administration, on "The Statistical Services of the Federal Government in Relation to the Recovery Program." Other early Committee interests have related to the Federal Statistics Board, the Marketing News Service of the Department of Agriculture, certain activities of the Bureau of Foreign and Domestic Commerce and the Bureau of Mines, the statistical and research program of the Federal Conservation Work, and various statistical problems of the Department of Labor. The latter have been given particular attention by the Special Advisory Committee to the Secretary of Labor, established at her request by the Association, the work of which is elsewhere discussed in the JOURNAL. This work is being financed by the Committee on Government

Statistics. A study of the statistical work of his department has been requested by the Secretary of the Interior, but this has not yet been undertaken at the time of this writing (July 7, 1933).

STUART A. RICE

FIFTEENTH CENSUS REPORTS ON POPULATION

The 1930 Census Reports on Population have now been published and occupy six volumes, with two additional volumes devoted to unemployment statistics.

Volume I of these reports gives the total population, without classification, for states, counties, cities and other incorporated places, townships or other minor civil divisions, and the wards of cities having a population of 5,000 or over.

Volume II is the general report on population and contains the most detailed of the tabulations by sex, color, nativity, age, etc. Figures are presented in this volume by states, with extensive tabulations for urban, rural-farm, and rural-nonfarm areas; in practically the same detail for cities of 500,000 or more; and in more condensed form for cities of 25,000 to 500,000. Comparative figures for one or two earlier censuses are usually given, and under each subject is a historical summary table presenting the data for the United States as a whole back to the earliest possible date. The subjects covered by this volume are indicated by the titles of the chapters, which are as follows:

1. Urban and Rural Population, Metropolitan Districts, and Center of Population
2. Color or Race, Nativity, and Parentage
3. Sex Distribution
4. State of Birth of the Native Population
5. Country of Birth of the Foreign Born
6. Country of Origin of the Foreign White Stock
7. Mother Tongue of the Foreign-born White Population
8. Citizenship of the Foreign Born
9. Year of Immigration of the Foreign Born
10. Age Distribution
11. Marital Condition
12. School Attendance
13. Illiteracy
14. Inability to Speak English

Volume III, which comprises 2,784 pages and is printed in two parts, presents less detailed statistics, state by state, under the following classifications: sex, color and nativity, age, country of birth, citizenship, marital condition, school attendance, and illiteracy, with preliminary figures for gainful workers classified by industry. All of these classifications are given by counties (with condensed tables for the rural-farm and the rural-nonfarm areas of the counties) and most of them for cities of 10,000 or more. Less detailed tables are given for incorporated places of 2,500 to 10,000, and still briefer presentations for incorporated

places of 1,000 to 2,500, for townships and for the wards of cities of 50,000 or over. Volume III is mainly to be used as a source of data for counties, for cities and other incorporated places having less than 25,000 inhabitants, for townships and for the wards of cities.

Volume IV gives the statistics of occupations, state by state. Gainful workers are here classified not only by sex and occupation, but also by color, nativity and age. Age is presented in detail for workers under 25 and then by 10-year periods up to 75. Special tables are presented for gainfully occupied women by marital condition, and for children in gainful occupations. The statistics are given in full detail for states and for cities of 100,000 or more, and in condensed form for cities of 25,000 to 100,000.

Volume V is the General Report on Occupations. In this volume the material is arranged by subjects rather than by areas, the chapter titles being as follows:

1. Enumeration and Classification of Occupations
2. Sex and Occupation of Gainful Workers
3. Color and Nativity of Gainful Workers
4. Age of Gainful Workers
5. Marital Condition of Occupied Women
6. Children in Gainful Occupations
7. Gainful Workers by Industry and Occupation

The explanatory material in Chapter 1 is very valuable for a clear understanding of the significance and limitations of the Census statistics of occupations. The classification of gainful workers in each industry by occupation, which is presented in Chapter 7, is an important contribution to the material for the analysis of the occupational status of the population of the United States. A similar classification was published in the reports of the Census of 1910.

Volume VI presents, state by state, the results of the 1930 tabulation of family data. There is no general report on families, though the United States Summary which stands at the beginning of Volume VI gives a considerable amount of summarized material for the United States, for states, and for cities of 100,000 or more. In this volume, statistics are presented for homes classified by tenure, for nonfarm homes classified by value or monthly rental, for dwellings, and for families classified by size, number of children, number of gainful workers, number of lodgers, color and nativity of head, age of head and employment status of home-maker. The number of families having a radio set is also given. These classifications are presented in varying degrees of detail for each state, by counties, with separate figures for urban, rural-farm and rural-nonfarm areas, and for cities and other incorporated places having 2,500 inhabitants or more. There are no family data for townships or for rural incorporated places, and no data on mortgaged homes.

Volume I of the Reports on Unemployment presents the data, state by state, including classifications by sex, color, nativity, age, family relationship, period of idleness and industry groups. Volume II is the General Report on Unemployment and presents the material by subjects. Most important of the new sub-

jects here presented are the classification of unemployment by occupation and the report of the special census of unemployment taken in January, 1931.

An excellent summary of the 1930 Census returns on population and unemployment is presented in the first half of the Abstract of the Fifteenth Census.

The material in all of the volumes listed above, except Volume II of Unemployment, has been published also in the form of bulletins or chapter reprints. Volume I is represented by the First Series of State Bulletins on Population; Volume III by the Second Series of State Bulletins on Population; Volume IV by the State Bulletins on Occupations; Volume VI by the State Bulletins on Families; and Unemployment, Volume I, by the State Bulletins on Unemployment. For each one of these series there is also a United States Summary Bulletin. The separate chapters of Volumes II and V are also available in the form of bulletins.

In addition to the regular reports, three special supplementary publications are now available, as follows: Metropolitan districts, foreign-born white families by country of birth of head, and age of the foreign-born white population by country of birth. A special report on the Indian population is ready for publication.

Circulars describing any of the Census volumes may be obtained upon request from the Bureau of the Census, Washington, D. C.

LEON E. TRUESDELL

COMMITTEE ON REPORTS AND STATISTICS OF THE AMERICAN PUBLIC WELFARE ASSOCIATION

The following is a digest of the report made at the Annual Meeting in Detroit, June 13, of the Committee on Reports and Statistics to its parent Association. Such material as does not deal with statistics or the Statistical Association has been omitted.

In line with one of the points in the Welfare Association's recommendations for standards in unemployment relief which makes it incumbent upon the state welfare departments to assemble state-wide data on unemployment, relief needs and relief expenditures, the Committee was pleased to coöperate with the Committee on Statistics of Relief and Child Care of the American Statistical Association (Neva R. Deardorff, Chairman) which recognized that there was definite need for study and coördination of the relief statistics now being compiled in the United States. It was recognized that state welfare departments are now setting up statistical series on relief which will undoubtedly persist for a long time and that every effort should be put forward to see that these systems are established on a sound basis. The close and cordial relations existing between the Welfare Association and the newly created Federal Emergency Relief Administration augurs well for the success of this undertaking.

This Committee was glad actively to participate in the work of the Advisory Committee on Child Welfare Statistics of the U. S. Children's Bureau, through which it is hoped to correlate existing statistical studies in the field, to secure

advice in connection with general policies of the social registration project, and to give specific consideration to the items of greatest importance to be collected and to the schedules to be used. It is planned to develop a handbook on child welfare statistics containing suggestions for basic records and statistics similar to those worked out in the fields of public health nursing and medical social service. This Committee is coöperating with the Committee on Statistics of Relief and Child Care of the American Statistical Association and the Advisory Committee on Statistics of the New York State Department of Social Welfare in working out an approved system for recording data in regard to child care in institutions and agencies in New York State. Appropriate forms for reporting, to the State Department of Social Welfare, the children taken under care and changes in their status while under care, have already been developed and a report is planned which will cover (1) all of the forms to be used in reporting to the state by these agencies, i.e., on individual children, on monthly movement of population and on annual income, expense and property transactions; and (2) the tables to be compiled from the data collected on these forms.

In connection with the New York State projects in registration of social statistics, this Committee, together with the Committee on Institutional Statistics of the American Statistical Association (Horatio M. Pollock, Chairman) and the Committee on Hospital Statistics of the American Hospital Association, has prepared hospital discharge schedules to be used by a small group of general hospitals in two of the larger cities of New York State. This schedule is designed primarily to show in addition to the usual identifying data regarding hospital patients, economic status of the patient, the preliminary and final diagnosis of his condition, the general nature of treatment, length of stay of patient and condition on discharge.

The Committee was happy to coöperate with the Law Institute of the Johns Hopkins University (Leon C. Marshall, Director) in its effort to work out "simple, inexpensive, readily mastered techniques, to secure a dependable, objective, generalized knowledge of a considerable part of the happenings in the trial courts"; and to extend the range of worthwhile criminal statistics to include the activities of the police, the prosecutor, the grand jury, the probation and parole authorities, the jail and prison authorities and the other agencies connected with the administration of criminal justice. In connection with the 1933 Prison Congress, this Committee is working with the Committee on Criminal Statistics of the American Prison Association (Edwin H. Sutherland, Chairman) in developing a program for the discussion of questions such as (1) For what purposes or occasions are statistical reports made in penal and correctional institutions? (2) What statistical studies are made for administrative purposes and is there a need for more statistical studies for administrative purposes? (3) What facilities exist for statistical work and in what respects should these facilities be improved? (4) Is there value in a long-time series of statistical tables which show trends, and for standardized forms that make possible comparisons of institutions?

Together with the Committee on Institutional Statistics of the American

Statistical Association, this Committee coöperated with the United States Bureau of the Census in the development of new and improved statistical schedules for use in the preparation of current and future reports of the Census Bureau, particularly on penal and correctional institutions, hospitals and institutions for mental and nervous diseases, and institutions for the mentally deficient and epileptic.

The Welfare Association and this Committee are participating in a three-year demonstration project in social statistics carried on by the Research Bureau of the New York State Department of Social Welfare which aims to establish the best methods of providing accurate information on the operation of social welfare agencies throughout the state. The results of this demonstration are expected to show what use is being made of public funds, the amount and kind of services provided by public and private agencies, and the distribution of the costs of such services between the agency groups.

Ostensibly as an economic measure a legislative bill introduced into the Pennsylvania Legislature (fortunately not approved) proposed to coördinate all of the social statistics collected by the Pennsylvania Department of Welfare in another department of the State Government. Asked by the Pennsylvania Secretary of Welfare for an expression of opinion regarding this proposal, the Committee has written protesting against such combinations and upholding Departments of Welfare.

The Committee on Reports and Statistics is composed of the following: A. L. Bowen, Illinois; Agnes K. Hanna, District of Columbia; Emma O. Lundberg, New York; Bennett Mead, District of Columbia; Horatio M. Pollock, New York; Elizabeth Yerxa, Wisconsin; and Emil Frankel, New Jersey.

INFLATION

A dinner meeting of the American Statistical Association was held on Thursday evening, April 20th, 1933, at the Hotel Woodstock, 127 West 43rd Street, New York City. Three hundred and thirty-four persons were in attendance. Professor Wesley C. Mitchell of Columbia University presided. The topic for discussion was "Inflation."

The first speaker of the evening was James Harvey Rogers, Professor of Economics at Yale University. He began by pointing out that the depreciation of the dollar resulting from the gold embargo was in considerable part psychological, as our long-run balance of international payments is still favorable.

Professor Rogers pointed out that the action of the United States in deserting the gold standard is quite contrary to precedent. In the past, many nations have been driven off the gold standard by forces beyond their control, but the United States took the step deliberately at a time when it was perfectly feasible to remain on a gold basis.

It is commonly believed that our going off the gold standard puts the United States in a stronger position to deal with other nations. The probabilities are

that fear of Hitler on the part of both Great Britain and France may make them more ready to come to an agreement with the United States than they would be under other conditions.

In the last analysis, all three countries want much the same thing. Genuine lasting recovery for all of us would be greatly facilitated by hard and fast agreements to move together toward: (1) A gradual and continued reduction of trade barriers throughout the world; (2) A raising of the world price level by an agreed upon percentage *and by no more;* (3) International coöperation in major money and central bank policies.

No reduction of the gold content of the money units should be undertaken unless done internationally and simultaneously. Independent devaluation would not only encourage the further growth of trade barriers of all sorts, but would most likely lead to an increased maldistribution of the world's monetary gold stocks.

There are many feasible ways of raising the price level. The difficulty is to stop the rise in prices when the point desired is reached. Nations in the past have often raised prices by inflationary policies. These inflationary policies have almost invariably resulted from unbalanced governmental budgets.

As the method most suitable at present for raising prices in the United States, Professor Rogers suggested the expenditure of large sums of money for the construction of public works. He held that the Federal Reserve banks should buy bonds in quantities sufficient to keep the member banks adequately supplied with reserves. At the same time, the Federal Government should float bond issues to pay for the public works. Since the member banks are still contracting the volume of deposit currency, the Government should, at the beginning, spend not less than seven hundred million dollars per month in order to assure the prompt return of prosperity. To make possible the flotation of such large issues, buyers would have to be guarded against depreciation in case the rate of return on later flotations were raised. A provision making all earlier issues redeemable (at the option of the holder) into any later ones is perhaps the simplest and safest device for accomplishing this purpose. The speaker closed by emphasizing the importance of arranging in advance to stop inflation whenever the price level rose higher than the goal determined upon as ideal.

The second speaker of the evening was Ralph West Robey, Financial Editor of the *New York Evening Post*. He opened by defining inflation as "creation of artificial purchasing power." Rising prices are not inflation but inflationary results.

Inflationists tell us that a rise in prices will lessen the debt burden. They overlook the fact that inflation normally results from the creation of debt by the Government. What happens is that Government debt is being substituted for private debt. The idea that inflation will help our foreign trade is largely fallacious, for, as soon as it produces the hoped-for result of raising domestic prices, all of our advantages in foreign markets disappear. The real force behind the inflation movement is mainly the desire of the speculative fraternity to foster activity in the stock market.

Mr. Robey stated that inflationists believe that rising prices will stimulate business, ease the burdens of debtors, and increase the volume of international trade. To accomplish these purposes, the following methods have been proposed: (1) Print paper money and use it to pay Government expenses; (2) Borrow heavily to meet the Government deficit; (3) Dilute the currency either by introducing silver as standard money or by reducing the gold content of the dollar; (4) Have the Federal Government or some of its subsidiary agencies lend money to bolster up tottering enterprises; (5) Disburse large sums for doles or expenditures on public works.

It is true that measures can be inaugurated which will raise prices. The difficulty is that, when prices are raised by inflationary methods, there is no way of saying which one shall be raised most. Our present troubles are due largely to the fact that prices are out of equilibrium. There is no reason to suppose that inflation would raise most those prices which have fallen most. Therefore, a rise in the average of all prices might leave price relationships as badly out of balance as they are at present. Furthermore, the fact must not be overlooked that, as long as private investors are taking money out of circulation, there is no certainty that the Government can raise prices by putting more money into circulation.

The policy followed by the Federal Administration since March 5th has been such as to undermine public confidence seriously. The banks, the insurance companies, and the mortgage guarantee concerns have all been forced to violate their contracts. In addition, the Federal Government has repudiated its own promises to pay gold on demand. It has even gone so far as to threaten with imprisonment citizens holding gold obtained by perfectly honorable means.

Confidence has been further shaken by the likelihood that the Farm Relief Bill will be passed. The provisions of this bill practically constitute a blank check on the Treasury. Once it is in operation, no one can ever ascertain the actual future situation of the Treasury. No one is able to guess what it will cost the nation. The Government has been going into the banking business. The reforestation program, which is starting out so innocently, is likely to attain titanic proportions. The latest proposal is that, if the Federal Reserve banks fail to purchase three billion dollars' worth of Government bonds in the open market, the Secretary of the Treasury will issue that amount of greenbacks. Each of these measures has undermined confidence.

The program which ought to have been inaugurated is in sharp contrast to the one which has actually been followed. Steps should have been taken to restore confidence in the American dollar. Unless we can, in some way, restore confidence, we will not have controlled inflation but we will have financial debauchery, exemplified by wild speculative activity followed by collapse within a few weeks or a few months at the most.

Dr. Robey's remarks were followed by discussion from the floor. Dr. Leland Rex Robinson inquired as to whether there is any evidence that depreciation of its currency tends to stimulate a nation's foreign trade. Professor Rogers felt this connection to be an established fact, but Dr. Rufus Tucker stated that

statistical inquiry shows that those European countries which have depreciated their currencies have not succeeded in increasing their exports. Professor Rogers contended that exports had continued to decline because of the downward movement of the business cycle and that they would have declined much further had it not been for the currency depreciations in the countries mentioned. Dr. Tucker retorted that this failure of exports to respond to currency depreciation was characteristic of various countries at various times in all phases of the cycle, and is not confined to periods of falling business.

Mr. Donald B. Woodward took issue with Dr. Robey's contention that an increase in the general price level would not raise most those particular prices which have fallen most. Mr. Woodward asserted that the fact is thoroughly established that prices of certain commodities fluctuate more readily than do those of other commodities. It is in recognition of this principle that index numbers of sensitive prices are constructed. There is, then, every reason to anticipate that any force tending to raise the average of prices will be responded to most readily by those sensitive commodities which have declined most during the past three years.

Mr. Woodward also felt that Dr. Robey, in his fear that life insurance and other savings will be rendered worthless by a policy of inflation, overlooked the fact that the deflation policy which we have been experiencing, if continued, will wreck both insurance companies and banks as it has already wrecked real estate mortgages and many commercial banks.

Mr. Woodward questioned also whether Dr. Robey's desire to balance the national budget could be attained were deflation allowed to run its natural course. Only with rising prices will taxes be productive enough to make budget balancing feasible.

Mr. Robert B. Warren agreed with Dr. Robey that repudiation does nothing to stimulate the making of new long-term contracts. Without such new contracts, business recovery can scarcely take place. Recent legislation may, therefore, do much to hinder business recovery.

Dr. George F. Bauer expressed the view that April, 1933, is a strange time to begin worrying about the integrity of the dollar. The people now so much concerned about it should have taken measures in 1930 to retain its integrity. The important question now is what measures can be taken which will help us pay our debts.

Dr. Bauer felt that our monetary difficulties were largely caused by the erection of tariff barriers, for these barriers have prevented commodity movements between countries and have, therefore, led to a wild scramble for gold.

Mr. Joseph V. Sherman expressed the opinion that one must have great faith if he still believes that prosperity can be restored merely by utilizing some abstraction like confidence. We have been playing the "confidence game" for three years, yet conditions have been steadily growing worse. What we need is more buying power for consumers. In a large proportion of families, purchasing power is practically exhausted.

Mr. Sherman also brought out the point that the ratio of total indebtedness

to total national wealth has been expanded to a point at which, if our present shrunken price level is maintained, it is practically impossible to pay all the debts.

Mr. Victor von Szeliski advanced the hypothesis that the reason that foreign trade does not respond readily to depreciation of the currency in any given nation is because tariff barriers and quota regulations prevent goods from moving freely from country to country.

WILLFORD I. KING, *Secretary*

WHO SHALL INHERIT AMERICA?

A joint meeting of the Population Association of America and the American Statistical Association was held, on May 12, 1933, at the Town Hall Club in New York City. Over one hundred members and guests attended.

Robert E. Chaddock, Past President of the Statistical Association, presided. The discussion centered upon the relation of the differential rate of natural increase among social classes to the quality of the population of the United States. Two papers were read, one by Dr. Frank Notestein, of the Research Department of the Milbank Memorial Fund, the other by Professor Frank H. Hankins of Smith College.

The first paper reviewed the factual situation with reference to differential natural increase among classes in the United States. There was general agreement as to the following observations: (1) The lower social classes increase more rapidly than the upper in each type of urban community and in rural areas. The rural classes increase more rapidly than the urban, and each urban class increases more rapidly in small than in large communities. (2) Probably this more rapid increase in the lower than in the upper classes goes back well into the nineteenth century. (3) The differences arise partly from differences in marriage age and, possibly, in the proportion of those who marry, but they are also the result of differences in fertility which are independent of these factors. The evidence suggests that they are in some measure attributable to the greater prevalence of purposive control of fertility in the upper than in the lower classes, even prior to 1910. (4) These differences in fertility are somewhat modified by the relatively high mortality rates of both adults and children which are characteristic of the lower classes. However, the influence of this factor is not sufficiently great to overcome that of differential fertility in bringing about the inverse relation between the rate of increase and social status.

The second paper, citing additional evidence from Western nations, accepts the conclusion that differential fertility, and consequent differential rates of natural increase among social classes, is a real phenomenon and not a new one. The discussion now centers upon the question, *Is differential fertility truly selective as regards the quality of the population?* To be selective differences of net fertility must be associated with inherent biological differences. If population is of uniform biological quality from class to class there is no selection. The conditions which would prove most definitely selective would be

(1) that the higher social classes are biologically of superior social worth, however this worth may be measured, (2) that the net size of families is less in the higher classes, (3) that more relatively of the upper classes fail to marry, and (4) that their average age of marriage is greater, thus allowing a longer span between generations. Professor Hankins concludes, in the light of our present knowledge, that all of the above conditions are fulfilled in both England and the United States.

The main question at issue is whether there are measurable differences in the biological quality of the social classes, estimated either in terms of physical traits or in terms of mental traits. Studies have shown physical differences, but in many cases the differences themselves are not imposing and might easily be explained by the cumulative effects of environmental factors; and in some studies the evidence is conflicting. The evidence seems more convincing from studies of mental differences. Mental ability appears to be correlated positively with social class, whether we distinguish social class by income, occupation or education. Professor Hankins cites the investigations of Lentz, Clark, Sutherland, Thomson and others in support of the hypothesis that intelligence of parents is negatively correlated with number of offspring; and that the intelligence of children is positively correlated with social status.

But all this evidence does not demonstrate that the upper classes are of superior biological quality. Superior mental ability is associated with superior environmental opportunity and vice versa. Assuming that the concept of mental levels is a valid one, we still face the difficult problem of determining the relative weights of the hereditary and environmental factors in determining mental levels. Professor Hankins marshals the evidence from studies of twins and orphans made by Wingfield, Sandiford, and Holzinger; the results of investigations among institutional populations which seem to indicate that the life in institutional homes has little or no tendency to make boys and girls more alike in I.Q.'s—studies made by Carr-Saunders, Lawrence, Wingfield, Hildreth and Davis, and Barbara Burks. From this evidence he concludes that the correlation found between intelligence and social status *is largely a consequence of the differences in the biological worth of the social classes. In other words, differential fertility is probably selective.*

This conclusion, Professor Hankins believes, is supported by certain *a priori* considerations. The more able men in the lower classes move upward. It is the conscious aim of our democracy to provide an open road for talent. Universal free education is designed to facilitate this movement. So far as innate intelligence is a factor in success, we should expect to find more of it at the top than at the bottom of the social scale. The cultural evolution through which we have been passing has called for all the latent talent which the population could supply. Moreover, the failure of the upper classes to add their full quota to succeeding generations has left vacancies to be filled from lower levels.

The total effect of these processes seems to Professor Hankins to be dysgenic. Our democracy has produced biological stratification. Assortative mating renders each level more like in its biological constitution. The differential birth

rate thus seems to be selective. We do not know, assuming the above to be a true picture, how rapidly this selection is going on. Moreover, changes in the birth rates, especially among the lower strata, may modify the dysgenic influence or eliminate it altogether.

The discussion of the two papers was opened by Dr. Frank Lorimer of the Eugenics Research Association, followed by Dr. Louis I. Dublin, Statistician and Vice President of the Metropolitan Life Insurance Company, and by Dr. Earl T. Engle of the College of Physicians and Surgeons, Columbia University. Dr. Lorimer thought the facts suggest that present differential fertility may be, in part, the expression of a lag in the spread of the pattern of family limitation among social classes. The differentials may soon tend to disappear through a leveling down of birth rates in the lower classes. Eventually birth rates in the upper classes may be raised by conditions more favorable to natality. In the meantime, economic and social measures which make rural life more attractive to superior families would be important from the standpoint of the quality of the population.

He emphasized the importance of determining trends in fertility by social classes, and urged repetition in the Sixteenth Census of the inquiry, "Number of children ever born?" in order to make possible a continuation of the Milbank Fund analyses over another decade. He also recommended that the analysis, discontinued since 1929, of birth registration data according to the age of the mother and the occupation of the father be taken up again by the Division of Vital Statistics of the Census Bureau. He argued in favor of closer attention in research to the operation of reproduction differentials in the transmission of characteristics developed through the operation of both hereditary and environmental forces.

Dr. Dublin, accepting, for the most part, the objective evidence presented in the papers, differed radically as to the significance of differential fertility among the social classes. He does not believe that it is a dysgenic influence, endangering the quality of our future population. He is assured from experience with health and insurance statistics that there is no fundamental difference between social classes in innate physical qualities. He would deny the conclusion which Professor Hankins cautiously draws from his evidence on the relation of mental ability to social status, that the upper classes are of superior biological quality and that the differentials, therefore, are selective. Mental differences between classes, he attributes also, for the most part, to environmental opportunity or to social handicaps. He maintains that we make our own poor.

In fact, Dr. Dublin criticizes fundamentally our entire concept of quality as at present defined, and questions the criteria used in the past to describe it—high intelligence as measured by I.Q., economic success, social position. He argues strongly for a new criterion, that of character. He would prevent, so far as possible, propagation of the degenerate and defective, but he is not seriously concerned with the effects of differential fertility among social classes. The environment should be modified so as to permit the young of all classes to develop to the fullest degree the innate qualities which they possess.

Dr. Engle closed the discussion by calling our attention to some of the physiological capacities involved in the concept of maximum fertility. He warned us also that "the physical and physiological characters which make for success in a profession or business are not the same as those which make good breeders. As a group, it seems biologically impossible that the same group should do both."

ROBERT E. CHADDOCK

Columbia University

PROGRESS OF WORK IN THE CENSUS BUREAU

THE ECONOMY PROGRAM

The general reduction in Government expenditures under the present economy program has, of course, affected the work of the Bureau of the Census, necessitating a readjustment of its plans for the current year and a curtailment of its activities, as the amount finally allotted to the Bureau is only about two-thirds of the amount asked for and estimated as necessary for carrying on its regular work without reducing salaries.

About one-half the reduction in the appropriation was automatically covered by the 15 per cent cut in Government salaries which went into effect on April 1. The remainder will have to be met mainly by a curtailment of the work of services of the Bureau, with possibly some further reduction of salaries through furloughs.

Some of the statistical inquiries which the Bureau has been conducting in recent years are not directly provided for or authorized by Act of Congress but were undertaken by order of the Secretary of Commerce under authority conferred by a general provision of the organic act establishing the Department of Commerce. Now that a reduction in the work of the Bureau is necessary because of reduced appropriations, it was considered that these inquiries, which were never sanctioned by Congress, not being expressly mentioned in the law defining the duties or functions of the Bureau, should be among the first to go. One of them is the annual compilation of statistics of marriage and divorce. It will be omitted for the year 1933. The compilations of current statistics of production (except those relating to cotton production) come into the same category—and have not been provided for in the budget of the Census Bureau. But in view of the great importance of these statistics at this time, the National Recovery Administration has sponsored this branch of work and will supply the funds necessary to carry it on in the Bureau with its present scope and detail for a period of at least six months, when the work may be placed on a more permanent basis and perhaps expanded.

The annual compilation of financial statistics of cities, which as provided by law, regularly covers all cities of 30,000 and over, will by Executive order be limited to cities of 100,000 and over. The compilation of financial statistics of states, being another of the inquiries not directly authorized by statute, will be omitted altogether for the current year.

A considerable saving will be effected by reducing the scope and detail of the

next biennial census of manufactures, which covers the year 1933 and will be taken in the latter half of the current fiscal year. In order to eliminate the expenses of field work and make it possible to collect the data by mail, the census will be confined to the principal industries, the minimum size of the establishments to be included in the canvass will probably be increased, and the schedules will be simplified. The census of 1931 included no establishments having an annual production of less than $5,000. It is probable that the limit for the next census will be raised to $20,000, perhaps even higher. A change of this kind reduces very materially the total number of establishments to be canvassed, without, at the same time, greatly reducing the other totals for the industries. For instance, increasing the minimum limit from $5,000 to $20,000 will reduce the number of establishments to be canvassed by nearly 33 per cent while producing a reduction of only 2.3 per cent in the number of wage earners and of hardly more than 1 per cent in the total value of products covered by the census.

The decennial census of institutional classes, as described in the March issue of this JOURNAL, will also have to undergo some curtailments. The census of jails, in which it was planned to obtain individual returns for prisoners committed during the year 1933, will cover only six months of the year. The census of paupers in almshouses will be postponed presumably until next year, as will also the inquiries with respect to charitable institutions for adults—such as soldiers' homes, old-ladies' homes, etc.—and likewise all the inquiries with respect to institutions for the care and placement of children.

With these curtailments in the scope and detail of its work the Bureau will probably be able to keep within the sum allotted to it for the collection of statistics, without reducing its present force by dismissals and without any very extended furloughs.

THE PRINTING SITUATION

The situation as regards the allotment for printing is much more serious. The lump sum allotted to the Department of Commerce for printing was reduced below the estimate; and the share that comes to the Bureau of the Census is entirely inadequate to cover the amount of printing that would regularly be done in the current fiscal year. Moreover, in addition to the reports that will regularly be completed this year, there are eight volumes of the reports of the decennial census still to be printed. These were all in type in the hands of the Government Printing Office and released for printing before July 1, and some of them had been printed and were ready for binding. As conditions were formerly they could be completed and charged against the unexpended balance of the appropriation for the previous year. But under the present budget regulations all work done on these volumes after July 1 will have to come out of the allotment for the current year. It is not clear at this time just how this situation can be met, but certainly some arrangement must be made whereby these volumes, as well as the reports for other inquiries that will be brought to completion within the current fiscal year, can be printed without any material abridgment or delay.

J. A. H.

MISCELLANEOUS NOTES

The Boston Chapter.—A luncheon meeting of the Boston Chapter was held on Friday, March 31, at the Boston City Club. The subject for discussion was "Present Conditions in Business and Finance." The discussion was led by Professor J. F. Ebersole of the Harvard School of Business Administration, Mr. N. E. Peterson, Economist, First National Bank, Boston, and Mr. Edward A. Filene of William Filene's Sons Company. Professor Ebersole spoke particularly with reference to general economic conditions and the credit situation. Mr. Peterson discussed financial conditions, and Mr. Filene spoke with reference to business conditions and measures for reconstruction. Following the brief addresses, there was spirited discussion of points raised by the several speakers.

At this meeting the President, Mr. Leroy D. Peavey, appointed Professor W. L. Crum of Harvard University and Mr. Howard C. Baldwin of Babson's Statistical Organization as members of a Committee to act with representatives of other organizations in preventing the impairment of essential social and scientific services which might result from a reduction in public expenditures.

The Sixth Annual Meeting of the Boston Chapter was held in the Auditorium of the Boston City Club on Friday evening, May 26, 1933. Dinner was served at 6.30 P. M.

Business Session: The business session was called to order at 7.30 P. M. by the President, Mr. Leroy D. Peavey, who reported with reference to the meetings held during the past year and recommended that, in addition to quarterly evening meetings, informal luncheon meetings be held occasionally. The annual reports of the Secretary-Treasurer were read and approved.

Officers elected for the ensuing year are: President—Professor J. Franklin Ebersole, Harvard Graduate School of Business Administration; Vice-President—Edmund S. Cogswell, First Deputy Commissioner of Insurance, Massachusetts Department of Banking and Insurance; Secretary-Treasurer—Roswell F. Phelps, Director of Statistics, Massachusetts Department of Labor and Industries; Counsellors—T. Frederick Brunton, Assistant Actuary, John Hancock Mutual Life Insurance Company; Howard C. Baldwin, Babson's Statistical Organization.

Speaking Session: The general topic for consideration at this meeting was "Inflation." Mr. E. C. Harwood, Assistant Professor, Massachusetts Institute of Technology, and author of *Cause and Control of the Business Cycle* was the principal speaker. The subject of his address was "Inflation: Possibilities of the Future." As a background for his remarks he described the distributing mechanism and the money-credit system as they have operated during the past, and displayed several illustrative charts. With reference to the future he stated as his opinion "that the best to be expected from devaluation of the dollar is a recovery, perhaps somewhat prolonged, but a later collapse which will presumably *not* bring the price level back to its recent low level. The net effect will probably be to lower somewhat the normal long term trend of industrial production."

The discussion was led by Mr. John H. Wills, First National Bank, Boston; Dr. Joseph B. Hubbard, Editor, *Review of Economic Statistics*, and Professor Donald S. Tucker, Massachusetts Institute of Technology.

The Chicago Chapter.—The final dinner meeting of the Chapter for the 1932–33 season was held on Tuesday, May 9, with Professor Garfield V. Cox, of the School of

Business, University of Chicago, as speaker of the evening. His topic, "The Administration's Recovery Program," brought out the largest attendance of the year. He discussed the Program in its relation to the field of money and prices, and pointed out which of the (at that time proposed) measures constituted deflationary and which inflationary action. The President's policy materially to raise the price level, he felt to be unwise, even though the rise could be checked through the various means of credit control, as the disparities between costs and price levels are not so serious as to warrant a considerable rise which might regenerate an unsound boom period. Professor Cox stated that the paramount need at the present is to restore employment and payrolls, and that foresight and courage are needed to recognize that all problems cannot be solved by inflation—a more balanced economy is needed. As regards the industrial control policy of the President, Professor Cox believes that the instrumentalities of government must be better perfected before political means of accomplishing economic ends can be successfully employed. However, he was rather encouraged by the President's efforts in the early weeks of his administration and pointed out that, after all, something depends on us.

The following officers and directors for the year 1933–34 were elected at this meeting: President, John L. Sweet, Federal Reserve Bank of Chicago; Vice-President, Dr. Howard B. Myers, Bureau of Labor Statistics, Illinois Department of Labor; Directors: John H. Noble, Armour and Company, H. B. Stair, Illinois Bell Telephone Company, and J. Gilbert, Mandel Brothers. Miss Marion Mead, Illinois Chamber of Commerce, will be the district secretary.

The Connecticut Chapter.—The Chapter held a dinner meeting in New Haven on April 26 with a record attendance. Professor James Harvey Rogers spoke on "Public Works vs. Inflation"; general discussion was opened by Professor Hudson Hastings. Meetings in Hartford and Bridgeport will be instituted in the fall.

Activities in Cleveland.—The final meeting of the Business Statistics Section was held on May first, at which time the members projected the Annalist Index of Business Activity.

The ninth annual meeting of the Cleveland members of the Association and the sixth meeting of the formal Cleveland Chapter was held at the Cleveland Chamber of Commerce Club on May 15. Forty-two members and guests were present. Mr. Green, retiring President of the Chapter, presided. Mr. Wembridge, Chairman of the Nominating Committee, presented the following nominations for officers for 1933–34: President: Dr. C. E. Gehlke, Western Reserve University; Vice President: D. A. Hill, Ohio Public Service Corporation; Secretary: E. A. Stephen, The Ohio Bell Telephone Company. The above nominees were elected.

Dr. Gaius E. Harmon, Associate Professor of Hygiene and Vital Statistics, Medical School, Western Reserve University, presented a paper on the "Measurement of the Influence of Certain Factors upon the Likelihood of Recovering from Lobar Pneumonia."

"Common Stocks in the Long Term Portfolio" was the subject of a paper presented by Gilbert Harold, College of Commerce and Administration, Ohio State University.

Howard W. Green, President of the organization during the past year, explained the purpose and methods used in the "Cleveland Real Property Inventory."

The Chapter was fortunate in persuading William F. Ogburn, past President of the American Statistical Association and Chairman of President Hoover's "Research Committee on Social Trends" to discuss the methods used by the Committee in its

work and to recount some of the obstacles met. Mr. Ogburn discussed some of the broader conclusions to which the Committee came in the course of its work.

The Columbus Chapter.—An unusually wide variety of subjects was presented by the speakers at the meetings of the Columbus Chapter in the year 1932–33. The papers were uniformly excellent and the discussions spirited. The average attendance at the meetings was thirty people. Dr. C. A. Lively, as president, Dr. R. W. Tyler, as executive secretary, and Dr. R. L. Dewey and Dr. H. A. Toops, as members of the executive committee, rendered very capable services to the club throughout the year.

The cost of government was the general topic of the October meeting. The national aspect was presented by Dr. H. F. Waldradt; the cost of state government in Ohio, by W. D. Hooper; and cost of local government in Ohio by H. R. Moore. The discussion was lead by R. C. Atkinson, B. A. Wallace, and Dr. H. H. Davis.

Dr. Viva Boothe and Dr. C. A. Dice presented papers on the current business outlook at the November meeting.

Experimental education was the general topic of the December meeting. Dr. F. H. Lumley presented a paper on statistical implications of studies of radio education; Dr. H. A. Edgerton discussed the application of statistics in educational guidance; and Dr. Fred P. Frutchey presented a paper on quantitative evaluations in college education.

The use of statistics in biology and in medicine was the topic of the January meeting. An illustrated talk on goiter was presented by Dr. George M. Curtis and a paper on statistics in the study of human heredity was presented by Dr. L. H. Snyder. The discussion was led by Dr. F. A. Hitchcock and Dr. Samuel Renshaw.

The February meeting was devoted to the international debt situation with Dr. Clifford L. James and Dr. Virgil Willet as the principal speakers. A lively general discussion followed the scheduled talks.

Recent changes in the agricultural situation were discussed by C. R. Arnold, Dr. V. R. Wertz, and P. G. Beck at the March meeting.

Recent changes affecting family life was the general topic of the April meeting. A paper on recent changes in consumer habits was presented by Dr. Grace M. Zorbaugh; W. J. Blackburn, Jr., presented a paper dealing with unemployment in Columbus and Cincinnati; and R. L. Dickinson, Secretary of the Columbus Community Fund, and L. S. Ford, publicity director of the Columbus Community Fund, presented material on indices of social service in Columbus since 1929.

The June meeting was devoted to statistical theory with a paper on small sample theory, read by Dr. C. C. Morris, and a paper dealing with new devices for aiding large scale research by Dr. H. A. Toops.

At the May meeting the following men were elected to office for the year 1933–34: President, Dr. R. W. Tyler; Executive Secretary, H. G. Brunsman; member of the Executive Committee for the two year period 1933–35, Dr. C. E. Lively. Dr. Ralph L. Dewey will serve the second year of his two-year term as member of the Executive Committee in 1933–34.

The Pittsburgh Chapter.—"The President's Program for Recovery" was the subject at the luncheon meeting of the Chapter, held at the Harvard-Yale-Princeton Club on Thursday, April 27. Former Mayor William A. Magee of Pittsburgh made the principal address, and M. W. Acheson, well known local attorney, led the discussion.

F. J. Chesterman, vice-president of the Bell Telephone Company of Pennsylvania,

discussed the report of the committee on the relation of consumption, production and distribution, of the American Engineering Council, at the May 25th meeting. Mr. Chesterman served as a member of this committee, which made an exhaustive study of the problem, and presented an analysis of the forty causes of business instability which were arrived at.

The very timely subject, "Inflation," was taken up at the meeting on Thursday, June 22. Dr. R. J. Watkins, Director of the Bureau of Business Research at the University of Pittsburgh, was the speaker.

Advisory Committee to the Secretary of Labor.—This Committee, whose appointment was announced in the June issue of the JOURNAL, is now affiliated with the newly established Committee on Government Statistics and Information Services. Staff services and a substantial fraction of the funds at the disposal of the general committee are allocated to this work in labor statistics, which has been planned in direct consultation with the Secretary of Labor.

The Advisory Committee has devoted particular attention to the immediate improvement of the current indexes of employment and the statistics of retail prices and the cost of living as compiled by the Bureau of Labor Statistics. In consultation with a special sub-committee, Miss Aryness Joy of the Division of Research and Statistics of the Federal Reserve Board, has developed a detailed procedure for adjusting the employment indexes to the Census. Miss Margaret C. Klem, formerly with the staff of the Committee on the Costs of Medical Care, is conducting for the Advisory Committee a detailed examination of the methods and materials used in the construction of the indexes of retail prices and living costs. Attention is also being given to needed revisions of the budget weights used in making up the cost of living indexes. A plan for a current rotating series of budget surveys is under consideration, with the prospect that an early experimental study in Washington may be undertaken by the Bureau of Labor Statistics. Mr. Murray W. Latimer has been retained to conduct an intensive appraisal of the mechanical and technical methods, the division of labor, organization and personnel of the several bureaus responsible for the statistical work of the Department.

Three meetings of the Committee have been held, on June 9th at the offices of the Social Science Research Council in New York, and on June 27th and July 12, 1933, in Washington, D. C.

The Committee may be addressed at Room 716, Department of Labor Building, or in care of the Committee on Government Statistics, Room 5519 Commerce Building, Washington, D. C.

United States Bureau of Labor Statistics.—Dr. Isador Lubin of the research staff of the Brookings Institution of Washington, D. C., has been appointed United States Commissioner of Labor Statistics and Director of the Bureau of Labor Statistics of the Federal Department of Labor. He succeeds Ethelbert Stewart who was appointed by President Harding in August, 1920, and who resigned several months ago. Dr. Charles E. Baldwin has been Acting Commissioner since Mr. Stewart's resignation.

The Bureau's semiannual cost-of-living study was made in June and the results published in the *Monthly Labor Review* for August.

The field work in connection with the annual survey of union wage rates and the surveys of wages and working hours in the glass, iron and steel, and bituminous coal industries has been completed. Reports on the investigations of wages and hours of

labor, in 1932, of common street labor hired by municipalities, of policemen and firemen, and of workers in the motor-vehicle industry have been published in recent issues of the *Review*, as well as a summary of the wage surveys made by the Bureau from 1928 to 1932 inclusive.

Other topics which have been the subject of special study, and of articles in recent issues of the *Review*, included prison labor in the United States in 1932; technological changes and employment in the electric-lamp industry; industrial disputes in the United States from 1916 to 1932; and labor turnover in the automobile industry, 1931 and 1932.

A series of articles on land settlement in various countries, based on reports furnished by representatives of the Department of State, is being carried in the *Review*.

The quarterly compilation on labor turnover in manufacturing industries, covering the first quarter of 1933, was published in the May *Review*.

Federal Emergency Relief Administration.—A Division of Research and Statistics has been established in the newly formed Federal Emergency Relief Administration which is administering the $500,000,000 federal relief appropriation, with Dr. Corrington Gill, formerly of the Federal Employment Stabilization Board, as Director of Research. Emerson Ross and Paul Webbink are associate members of the statistical staff.

United States Bureau of Agricultural Economics.—The summary of an address by L. H. Bean, now of the Agricultural Adjustment Administration, before Section K of the American Association for Advancement of Science, in a joint program with the Econometric Society, Syracuse, New York, June 22, 1932, has been mimeographed under the title "Characteristics of Agricultural Supply and Demand Curves."

The Index Numbers of Prices Paid by Farmers for Commodities Bought, published by the Bureau of Agricultural Economics since 1928, have recently been revised on the basis of more recent and more complete data. The different subgroups of the revised index are the same as when first published in 1928, but several additional commodities were added to the index during the period 1913 to 1922, thus providing a more accurate measure of the changes in prices paid by farmers during this period of rapidly rising and falling prices. The base period of the index remains unchanged, with the years 1910 to 1914 equal to 100, but the bill of goods used as weights in the index is now representative of farmers' purchases in the years 1925 to 1929 instead of 1921 to 1925, which latter period was used when the index was first published.

"Farm Mortgage Terms and Conditions, 1932–33," mimeographed in June, 1933, presents statistical and descriptive material relating to farm mortgage financing in 1932 as represented by the operations of mortgage bankers during that year. This, the fourth annual report of this series by the Division of Agricultural Finance, indicates that new loans constituted only 10 per cent of 1932 farm real estate financing, 90 per cent being renewals; 36 per cent of outstanding loans were delinquent; 90 per cent of loans made during the year carried some provision for payment on principal during the loan term. Interest rates to borrowers averaged 6.3 per cent per annum, though rates in many areas were nominal since no funds were available for lending. Comparisons are given with data for earlier years.

On June 19 the Secretary of Agriculture announced the discontinuance, June 30, 1933, on account of the necessity for economy, of the market news service of the Bureau of Agricultural Economics. On June 28 the Secretary's office announced that

adjustments had made possible a continuance of the market news service on a greatly reduced basis. Many of the Bureau's field offices, which were concerned with collecting data for the market news service, have been closed. Where offices are maintained, substantially the same information will be gathered as in the past, but the direct distribution of the reports will be restricted.

The services of many economists, statisticians, and agricultural leaders are being utilized in connection with the Agricultural Adjustment Administration of the United States Department of Agriculture. Mr. George N. Peek, prominent in agricultural organizations and work, and Mr. Charles J. Brand of the National Fertilizer Association (formerly Chief of the Bureau of Markets) have been appointed respectively Administrator and Coadministrator. Others connected with the organization are: A. G. Black, Iowa State College; Hon. Victor A. Christgau, formerly United States Representative from Minnesota; Cully A. Cobb, Editor, Progressive Farmer and Southern Ruralist; Chester C. Davis, for many years active in various agricultural organizations in the Central West and Northwest and formerly State Commissioner of Agriculture in Montana; C. F. Sarle, Federal Farm Board; H. R. Tolley, Giannini Foundation, University of California (formerly Assistant Chief of the Bureau of Agricultural Economics); M. L. Wilson, Montana State College of Agriculture.

L. H. Bean, E. W. Gaumnitz, J. B. Hutson, and Lawrence Myers have been transferred from the Bureau of Agricultural Economics to the Agricultural Adjustment Administration.

National Occupation Conference.—Under a grant from the Carnegie Corporation of New York, the National Occupational Conference was organized early in this year to coördinate and stimulate the work of existing organizations in the field of vocational guidance. The Conference is administered by the American Association for Adult Education and has offices with the Association and the Carnegie Corporation at 522 Fifth Avenue, New York City. The executive staff consists of Dr. Franklin J. Keller, Director, who serves while on leave of absence from the New York City Board of Education, and Robert Hoppock and Raymond Fuller, Assistants to the Director.

General R. I. Rees, Assistant Vice President of the American Telephone and Telegraph Company, is chairman of the Executive Committee, which will be responsible for formulation of policies and direction of activities of the organization. Professor Donald G. Patterson of the University of Minnesota is chairman of a Technical Committee.

The purposes of the Conference include the establishment of a clearing house of information for vocational advisors and those conducting research in the occupational field, the collection and collation of studies and reports in the field, as well as the stimulation of research concerning vocational guidance, occupational trends and other economic phenomena affecting employment. In coöperation with the National Vocational Guidance Association, the Conference assumes the publication of the *Vocational Guidance Magazine*, which is now entitled *Occupation*.

The International Yearbook of Agricultural Statistics.—The International Institute of Agriculture at Rome has recently published the 1931–32 edition of the *International Yearbook of Agricultural Statistics*.

This volume of about 800 pages is the result of the most extensive and detailed inquiry made in the domain of international agricultural statistics and constitutes a

work of the greatest importance to all those who are interested in questions having a direct or indirect relation to production and commerce of agricultural products.

In the first part of the *Yearbook* are classified the figures for area and population in the years nearest to 1927 and 1931 for 208 countries. The second part is composed of a series of tables comprising for nearly 50 countries the available data concerning the uses for which the total area is employed, the apportionment of cultivated areas between the different crops, agricultural production, numbers of the different kinds of livestock and the products derived from them. In the tables constituting the third part of the volume, have been indicated for nearly 40 agricultural products, the area, production and yield per acre in each country during the five years 1923–1927 and during each of the years from 1928 to 1931.

For each kind of livestock all available figures in the different countries have been grouped for the years 1927 to 1931. A large part of the volume is devoted to statistics of the commercial movement of 43 vegetable products and 13 products of animal origin. The figures published relate to the imports and exports during the calendar years and for the cereals also during the commercial seasons.

It may be added that the tables of production and commerce not only specify details for each country but also the totals for the different continents and hemispheres and for the whole world, allowing the formation of a general idea of the changes taking place during the periods under consideration in the area under each crop, quantities harvested and the commercial movement in each product.

The part devoted to prices contains the weekly quotations of 25 agricultural products on the principal world markets for the period January, 1927, to July, 1932. In the freights section will be found the quotations for the transport of wheat, maize and rice on the most important shipping routes, and in the section reserved for fertilizers and chemical products useful in agriculture are published statistics of production, trade, consumption and prices for 15 products. In the Appendix have been brought together special chapters on the distribution of agricultural holdings according to their size and mode of tenure. The Forestry Statistics have been extended and developed and will be published in a separate volume under the title of *International Yearbook of Forestry Statistics.*

New Unemployment Survey of New Haven, Connecticut.—Opportunity for repetition of the unemployment survey of families in New Haven, Connecticut, which was made in May–June, 1931 [1] by Margaret H. Hogg of the Department of Statistics of the Russell Sage Foundation in coöperation with the Yale Institute of Human Relations, was offered in a comprehensive statistical survey of New Haven families conducted by the Institute in May–June of this year, under direction of Dr. Mildred B. Parten. Miss Hogg was invited to plan and supervise the employment-unemployment portion of this year's study.

Approximately twice as much unemployment was found this May as two years ago, the percentage of idleness from lack of work this year being 35 for men earners and 28 for women earners. In more than 14 per cent of the families all earners were idle. Idleness rates by age, by occupation, and by industry, show fairly consistent doubling over 1931, but whereas two years ago least unemployment among men was found in the early thirties, the lowest rate this year occurs in the early forties. Among professional and executive workers, and especially among people who conducted their own business, who two years ago were still relatively lightly hit, lack of work has much more than doubled.

[1] Results published in "Incidence of Work Shortage."

On methodology this second study has yielded results not possible in the first. Comparison of schedules for identical families at the two dates has thrown light on various difficulties of enumeration processes. Instances are the variability of information on age, and the difficulty of insuring that all members of a composite family are enumerated. Comparison of statements concerning both the length of present unemployment and the length of residence in the present dwelling displayed the memory's disconcerting tendency to exaggerate the length of time that the current condition has lasted.

A report on the employment situation in New Haven in May, 1933, will later be published by the Russell Sage Foundation.

The Brookings Institution.—The Institution has awarded fellowships to nine men and two women for the academic year 1933–34. Several of these awards were made coöperatively with universities, making it possible for selected graduate students and younger faculty members to study in the national capital under the auspices of the Brookings Institution. The subjects on which the new fellows will concentrate range from "Foreign Exchange Control" to "The Attitude of the American Clergy from 1890 to 1900 toward Imperialism, and the Effect These Men Had on Public Opinion in the United States." Nine of the fellows are of American birth, one is Canadian, and one German. The list of successful applicants is as follows: Charles A. Annis, Cornell University; Jeannette L. Berger, Radcliffe College; Charles J. Coe, Brown University; Henry H. Edmiston, Yale University; Lee S. Greene, University of Wisconsin; James C. Nelson, University of Virginia; Helen C. Sands, Radcliffe College; Dr. Rainer W. Schickele, Iowa State College; Edward C. Simmons, Ohio State University; Leroy D. Stinebower, University of Chicago; John H. Thurston, Harvard University.

Paul T. David, Brookings fellow 1932–33, is serving with the Tennessee Valley Authority. Robert Connery, Brookings fellow 1932–33, has been appointed instructor in the Extension Division of Columbia University.

Y. S. Leong, a former Brookings fellow, has completed work for the doctorate at Columbia, and his thesis—"Silver: An Analysis of Factors Affecting Its Price," has been published by the Institute of Economics. Dr. Leong has accepted a position with the National Recovery Administration, Division of Research and Planning.

The Public Administration Clearing House, under the direction of Louis Brownlow, is opening a Washington office at 734 Jackson Place, with Lewis Meriam as the Washington manager.

Taylor G. Addison is serving as assistant director in charge of the Washington, D. C., administrative office of the United States Employment Service of the Department of Labor.

Benjamin P. Whitaker has been appointed director of research of a special tax commission for Connecticut.

Henry P. Seidemann is coöperating with the Director of the Budget in a revision of the itemization of accounts and appropriations.

Fred W. Powell is serving on a temporary appointment as one of the four experts who will coöperate with the Federal Coördinator of Transportation.

President Roosevelt has appointed Dr. Isador Lubin to the post of Commissioner of Labor Statistics; and the Federal Public Works Administration has appointed Dr. Lubin chairman of its Labor Policies Board.

Max Sasuly has completed for the Institute of Economics his study entitled "Trend Analysis of Statistics: Theory and Technique," and has accepted a position

as senior statistician with the National Recovery Administration, Division of Research and Planning.

Dr. Frieda Baird, a former Brookings fellow and staff member of the Institute of Economics has accepted a position with the Farm Credit Administration.

Lewis L. Lorwin was selected as a delegate by the American Council of Pacific Relations to attend the Fifth International Conference of the Institute, held in Banff, Canada, from August 14 to August 28. This conference was devoted to an examination of conflict and control in the Far East.

Personals

Dr. Stuart A. Rice, President of the American Statistical Association and formerly professor of sociology and statistics at the University of Pennsylvania, has been appointed Assistant Director of the Census. This was formerly a temporary office, created for the duration of the decennial census, but it is now made permanent.

There has been established in the Bureau of the Census a division of statistical research to which Dr. Joseph A. Hill has been assigned as Chief Statistician. Dr. Hill, President of the American Statistical Association in 1919, has been connected with the Bureau of the Census since 1899. He was appointed Chief Statistician in 1909 and in 1921 was made Assistant Director for the Fourteenth Census. He held the same position during the Fifteenth Census.

Mr. Z. R. Pettet, formerly agricultural statistician in the Department of Agriculture and later in the Bureau of the Census during the Fifteenth Census period, has been appointed Chief Statistician for the Division of Agriculture.

Dr. Leo Wolman of Columbia University and the Amalgamated Clothing Workers of America, and Review Editor of our Journal, has been appointed a member of the Advisory Board representing labor, which is assisting in the administration of the National Recovery Act.

Professor John H. Williams was graduated from Brown University and took his doctor's degree in economics at Harvard in 1919. After teaching experience at Brown University, Princeton University and Northwestern University, he became professor of economics at Harvard. In addition to his academic work, Professor Williams, from time to time, has carried on other undertakings, including service as assistant editor of the *Harvard Review of Economic Statistics*, and the organization and development of the annual studies of the balance of payments of the United States now published by the Department of Commerce. Last autumn, Professor Williams, with Dr. E. E. Day, was appointed to represent this country upon the Committee of Experts which prepared the agenda for the forthcoming World Economic Conference.

Professor Henry Schultz, of the University of Chicago, who has been appointed to a fellowship of the Guggenheim Foundation, will spend the year 1933–34 in Europe, conducting studies in the field of mathematical and statistical economics.

Dr. C. Luther Fry, formerly of The Institute for Social and Religious Research, has accepted the appointment as head of a new department of sociology at the University of Rochester. It is hoped that the program of the department will include significant developments in social research.

Dr. Paul R. Rider of Washington University, St. Louis, has been engaged by the United States Business Trends Corporation of Columbus for some consulting statistical work. He spent the summer in Columbus.

The Foundation for the Advancement of the Social Sciences of the University of Denver sent Dr. A. D. H. Kaplan, professor of economics, as an observer to the World Monetary and Economic Conference which opened in London on June 12. He represented Colorado and the Rocky Mountain region.

Professor Hornell Hart has resigned the chair of social economics at Bryn Mawr College to become professor of social ethics at the Hartford Theological Seminary at Hartford, Connecticut.

J. Herbert Leighton, recently assistant to the president of the Bush Terminal Company, and formerly with the American Telephone and Telegraph Company, is now associated with the treasury department of the New York Life Insurance Company, where he is conducting statistical research concerning railroad organization.

John Dunphy will join the faculty of the University of Denver in September, 1933, as an instructor in the economics department. He formerly taught at Regis College in Denver, and the College of St. Teresa in Winona, Minnesota.

Charles B. Davenport and Merle P. Ekas are planning a revision of *Statistical Methods* and should be glad to receive any forms, schedules, accounts of methods of institutes, and of apparatus for inclusion in the book. Address Charles B. Davenport, Cold Spring Harbor, New York.

ADDITIONAL COMMITTEE APPOINTMENTS

Committee on Calendar Reform

M. B. Folsom, *Chairman*
S. L. Andrew
H. S. Carter
W. J. Donald
E. D. Durand
A. H. Hedrich
C. F. Marvin
R. P. Towne

Committee on Government Statistics and Information Services

Edmund E. Day, *Chairman*
Stuart A. Rice, *Acting Chairman*
Meredith B. Givens, *Executive Secretary*
Morris A. Copeland
William L. Crum
Bryce M. Stewart
Willard L. Thorp

Advisory Committee to the Secretary of Labor (additional appointment)

Murray W. Latimer, *Secretary*

Committee to Welcome Delegates to the International Statistical Institute upon Their Arrival in New York

Haven Emerson, *Chairman*
Robert E. Chaddock
Leon Henderson
Willford I. King
Edgar Sydenstricker
Walter F. Willcox

Committee on Chapter Relationships

John L. Sweet, *Chairman* — Roswell F. Phelps
Howard G. Brunsman — Edward A. Stephen
Clarence Tolg

MEMBERS ADDED SINCE JUNE, 1933

Berglund, Winifred V., Graduate Student, Northwestern University, Evanston, Illinois

Borgwald, John H., Ohio Bell Telephone Company, 750 Huron Road, Room 1501, Cleveland, Ohio

Brodie, Israel B., Lawyer, 2160 Graybar Building, New York City

Cramer, Edison H., Instructor and Assistant Secretary of the Bureau of Business and Government Research, University of Colorado, Boulder, Colorado

Davis, Lawrence M., Mail Order Sales Department, Montgomery Ward and Company, Chicago, Illinois

Fisher, Waldo E., Industrial Research Department, University of Pennsylvania, 3440 Walnut Street, Philadelphia, Pennsylvania

Gere, Francis M., Analyst, E. L. Phillips and Company, 50 Church Street, New York City

Gilaryi, Lawrence, Securities Analyst, Fitch Publishing Company, 138 Pearl Street, New York City

Gilbert, Jack J., Analyst, 1 North State Street, Chicago, Illinois

Iglauer, Jay, Vice-President, Treasurer and Controller, The Halle Brothers Company, 1228 Euclid Avenue, Cleveland, Ohio

Ingraham, Olin, Professor, Massachusetts Institute of Technology, Cambridge, Massachusetts

Marvin, Dr. Charles F., Meteorological and Solar Statistics, U. S. Weather Bureau, Washington, D. C.

Miller, Raymond F., Southern Pacific Company, Room 2117, 165 Broadway, New York City

Ochs, Jack, Student, School of Commerce, New York University, 236 Wooster Street, New York City

Rose, Raymond, 1716 Caton Avenue, Brooklyn, New York

Schumpeter, Dr. Joseph A., Harvard University, Cambridge, Massachusetts

Seidl, Julius C., Graduate Student, Fordham University, Woolworth Building, New York City

Shailer, Frank A., Actuary, 393 Seventh Avenue, New York City

Sheng, T., Vice-Chairman of National Tariff Commission, Customs Building, Hankow Road, Shanghai, China

Sutherland, Dr. Edwin H., Criminal Statistics, University of Chicago, Chicago, Illinois

Witmer, Dr. Helen L., Smith College, School for Social Work, Northampton, Massachusetts

REVIEWS

Recent Social Trends in United States. Report of the President's Research Committee on Social Trends. New York: McGraw-Hill and Company. 1933. 2 Vols., 1568 pp.

These two volumes are truly a cyclopedia for social scientists drawing upon the material contained in the thirteen books being published by the same Committee, the books on monetary and financial problems of the National Bureau of Economic Research and the many detailed investigations of individuals. It is not surprising that the investigation should be made at the request of an engineer, ex-President Hoover, for an engineer requires all of the available facts and interpretations as the basis for his own action. The series of reports dating back to 1921, of which this and *Recent Economic Changes* are the culmination, may be counted as a great contribution by him to social science. This contribution stands even though a great national emergency forced him to act so quickly and experimentally that it was impossible to await the slow process of economic and social investigation.

The volumes are essentially clear and coherent summaries of the enormous output of materials from investigations previously made, though it also includes some important materials not previously published. All of this material was digested, summarized and coördinated by the forty authors of the volumes, all of whom are recognized authorities for several years past in their own special fields.

The task of giving to the layman a short, clear, comprehensive picture of the most important related social trends in America is immense and we are greatly indebted to the distinguished Committee as well as the specific collaborators. The material compiled in the thirteen separate monographs is combined with other data and condensed into twenty-nine reports of about fifty pages each on the important fields of social activity investigated. These summaries are then brought together into something like a unified whole in the seventy pages of "findings" of the Committee. This summary will be first read by the layman for a bird's eye view of the entire field embracing both the interrelationships between the parts and the bold outlines of each field investigated. The more careful student will explore further into each field of his interest.

Such an interrelationship is exceedingly difficult to picture and the ramifications are so vast and the designation of "fields" so arbitrary that one cannot expect the "findings" to picture fully all of social activity. It appears that even with these limitations more could be done to suggest the important ways in which trends noted in one field affect others. Although this has been portrayed sufficiently well to be suggestive it still is true that the volumes stand primarily as a compendium of valuable material rather than as a unified picture.

The individual authors and especially the members of the Committee in charge of the work have in other places given us insight and understanding of the fields

of their specialities. An investigation under the injunction to present a "complete, impartial examination of the facts" is not the place to look for such insights. The Committee frankly recognizes that the trends "run forward into the series of questions raised but not answered." And this is proper for "nothing short of the combined intelligence of the nation can cope with the predicaments." For the work merely presents the raw material for actual social decision and scientific pioneering. It summarizes the body of facts already available. It remains for the social engineer, the social statesman, and in fact for any group leader to make use of the data and to convert interpretation of past trends into present action and social purpose for the future. If these volumes have been criticized as trite, it is because the critic has misunderstood the function of the Committee. An individual may yield new interpretations of data based upon his insights and his scales of values; a group may express a purpose through the remolding of the social data; but a Committee can merely present either with the raw data.

When a trend has been studied, it is almost inevitable that the question shall be raised whether the trend can be used as a basis for forecasting by extrapolation. Can we guess social activities into the future on the basis of such investigations? The long sweep of many of the trends noted and the breadth of the changes suggest the likelihood of their continuance. Yet the very interrelationship suggested by the Committee makes extended scientific predictions impossible. So the reports suggest an understanding of present problems without implying that the very handling of those problems would not change the character of the trends. The Committee could not be expected to know of the revolutionary changes in politic-economic organizations that are occurring since its study was completed. It could and did note that the lag between the trends it has investigated presented the problems to the country in an acute form.

The concept of an equilibrium between rates of change in social trends has been well exploited in the two volumes. The strains in a social structure which appear because some aspects of community life more readily adapt themselves to new conditions than do others help to suggest the social problems that are thus presented. The concept was used as a mental tool for finding and interpreting the problem rather than depended upon for a solution. The solutions must come from the man of social insight and from those who have power to define public purpose.

In general the Committee noted the general tendency for both industry and government to expand their activities and extend the range of their operations, while both the church and the family have declined in influence. In somewhat more detail, the Committee noted the social problems resulting from: the greater increase of physical production than consuming power, the increase in fixed investment and the staple labor supply by declining public preference for the railroads, the greater increase in machinery than in durable consumers' goods and the increase in consumer staple articles at a much smaller rate than either the intensifying industrial concentration at the same time as a decline in the strength of labor organizations, increasing sales pressure along with an increas-

ing dependence of the consumer on the market and a decreasing knowledge of the quality of commodities, an enlarging agricultural productivity and a diminishing rate of growth in the demand for agricultural products, an increase in the broader capacities of individuals but a slow change in educational methods and controls, a rapid increase in the need of governmental supervision and slow change in political institutions. There are many more which the Committee notes, and still others which it implies when it indicates it has not handled the issues that center around the cause of the current depression, basic economic changes, peace and war, international relations and the development of knowledge in the social sciences.

From the combined wealth of materials assembled together by leading students in their respective fields no student of social relations can fail to draw a great deal of data and useful interpretations for his own understanding.

JOHN R. COMMONS

University of Wisconsin

World Social Economic Planning. M. L. Fleddérus, Editor. The Hague: International Industrial Relations Institute. 1932. 2 Vols., lxiii, 935 pp.

This is the second publication resulting from the World Social Economic Congress held at Amsterdam in August, 1931, under the auspices of the Industrial Relations Institute, and consists of the papers and discussions of the conference, including an interpretation by Dr. Max Lazard of the previously-printed reports on actual conditions of unemployment in the different countries. Papers and discussions are in French, German and English; and the principal contributions, in whichever language presented, are accompanied by full translations or synopses in the other two tongues. Miss van Kleek, the Chairman of the Program Committee, contributes a review and summary of the entire conference.

The conference started with no previous agreement as to the meaning of planning, and the materials cover many variants, both as to scope and as to the degree of central authority involved. As was to be expected, the conference reached no agreement, unless it were on the seriousness of the problem, as to the desirability of some change in world policies and the topics on which further research would be desirable. There was, however, virtual unanimity on the need of a greater measure of concerted action. It was unanimity broken only by the lone voice of Dr. Benham, who mildly suggested that if we tried the experiment of economic liberty (as we have not done for some decades) it might be found to work better than the nondescript policies which have actually been in force.

The materials of the proceedings may be roughly divided into three groups. First come surveys of existing economic conditions, including Dr. Lazard's survey of causes of unemployment and Dr. Neurath's assessment of developments and capacities of production. Second come existing forms of planned or concerted action, including the Soviet form, and various forms of limited scope or objective, existing within the framework of so-called "capitalist" society.

Here belong Dr. Haan's treatment of rationalization; Dr. Palyi's succinct account of the failure of international industrial combines to achieve stabilization; Professor Chamberlain's study of the development of the multilateral treaty toward a form of international government; Albert Thomas' plea for maintenance of labor standards, to the advancement of which the International Labor Organization is dedicated; and other interesting contributions. Third come proposals for some form of planning not now in existence, or philosophies driving toward some new goal. These include detailed proposals such as Dr. Broda's suggested changes in the constitution of the League of Nations, or general concepts such as Dr. Lorwin's definition of social-progressive planning as distinct from other types. Dr. Person's treatment of scientific management seems to belong with this group, because the whole burden and emphasis is on the logical necessity with which the application of the principles of scientific management has broadened step by step until the inevitable next step is the coördination of the business system as a whole.

The discussion, quite naturally, leaves unsettled the central question of planning: namely, can we secure sufficient concerted action to bring about the main ends of industrial stabilization and a high general standard of living without going the whole length of socialism and substituting collective for private ownership? The Soviet representatives say no, and Dr. Heinz Ludwig calls Dr. Person a Socialist who has not drawn the consequences of his principles. Dr. Person, on the other hand, speaks of himself as interested in the possibilities of evolutionary development in which, as he clearly implies, authority would follow function wherever new functions develop rather than remaining vested in formal and traditional ownership. We know that functions traditionally bound up with ownership are being redistributed without formal transfer of ownership itself. Whether this process can go far enough for the main ends in view—that no one can tell us. But it seems clear that the character of the business unit must change greatly before voluntary coöperation of such units will set up an authority that will actually keep social forces at work to satisfy social needs, rather than trying to stabilize profits and failing as international cartels have failed.

One achievement of the conference was to bring official representatives of the Soviet planning organization to discuss their planning system on the same platform with non-communists. The result is highly enlightening, despite the inevitable color of propaganda, and the baffling inconclusiveness of most of the statistics cited. (This last Dr. Lorwin points out with the utmost good humor.) The usefulness of the conference might possibly have been increased by the inclusion of the more socially-minded forms of American business plans for planning, as represented by the proposals of Mr. Swope and of the National Chamber of Commerce. A serious attempt to gauge how far these really differ from the "social-progressive" type might have brought forth something of value.

If the reviewer were to attempt to assess the value of this conference as a whole, his judgment would inevitably be subjective. It would express his conviction that the irresistible trend of events is toward more correlation and con-

certed control; and that, this being the case, it is of vital importance to give representation to the views of those who think of the economic system as a whole, and basically as an instrument for furnishing the necessities of life and means of welfare for the whole people, and whose ideas of planned stability will run in these terms, rather than leaving the field to those who see it in terms limited to the socially futile particularist machinery of trade barriers, industrial combinations, valorization and the like. For a more objective verdict the world must wait, perhaps for generations, to see if the trends of history bear out our present impressions. But the action that will determine these trends cannot wait for this final verdict.

J. M. Clark

Columbia University

The Economic Results of Prohibition, by Clark Warburton. New York: Columbia University Press. (Studies in History, Economics, and Public Law No. 379.) 1932. 273 pp.

Dr. Warburton's study is an analysis, largely statistical, of the available facts bearing on the arguments for and against prohibition. A statistical table appears, roughly speaking, on every other page. The author resists the temptation to settle the prohibition controversy by setting forth his own opinions and prejudices. He pushes his analysis as far as the facts and statistical methods permit: the controversies among people for whom facts have no meaning are left out. For example, he does not attempt to say what the economic results of prohibition would have been if prohibition had prohibited. He is fully conscious of the great difficulties of an analysis limited to the facts, because the facts of the era of attempted prohibition are the resultants of all the many forces at work in that lively period. In general, Dr. Warburton's method is to determine a pre-war trend or correlation and observe the changes since prohibition. If this method is not always fully conclusive, the answer is that there are no better methods and that an approximate answer is better than none. Insufficient data do not permit the measurement of the effects of prohibition on industrial productivity, absenteeism, and accidents.

Dr. Warburton's conclusions appear most firmly established where he deals with the expenditures upon and consumption of alcoholic beverages. His conclusions on the effects upon the farmer and upon the taxation of the rich appear most questionable, even in their qualified form. The lost market to the farmers was more than made up by the increased sales of milk, but the connection between the sales of alcoholic beverages and the sales of milk is open to question. The distribution of the burden of public expenditures is so much a question of opinion about social justice that the reviewer doubts that the loss of public revenue from the beverages added to the burdens of the rich. On these points, the reviewer prefers a more skeptical or agnostic position.

Dr. Warburton's book is both encouraging and chastening to the social scientist. We are much better off for such a book—how much has been rescued

from sterile declamation! And yet—how much is left in the realm of the unknown and unknowable even by such a vigorous and painstaking study!

R. S. MERIAM

Harvard Business School

The National Income, 1924–1931, by Colin Clark. London: Macmillan and Company. 1932. 167 pp.

Mr. Clark first compounds the national income total for the United Kingdom for 1924 and 1928 from data on assessed incomes, estimates of non-wage incomes exempt from tax, and an estimate of wages. With the help of tax data and various indexes, estimates are then made for the years 1926 through 1931. The totals thus arrived at are distributed among various factors of production. Some notion of the personal distribution of incomes by size is given for 1924 and 1928, although the data do not permit any apportionment at the lower end of the income scale. The real earnings per occupied person and per family are computed for 1924 and 1928–31. The production side of income is studied in detail for 1924 and 1927–31. For the same years, national income is analyzed on the expenditure side, as between consumption and investment. Price indexes for various groups of productive services are presented for the years 1924–31. And finally, Mr. Clark presents an analysis of prices, costs, investment and saving, utilizing Mr. Keynes' equation and definitions.

The book is thus a veritable mine of information in the field. Anyone not thoroughly familiar with British statistics finds it next to impossible to evaluate the reliability of the numerous measures presented. It is obvious, however, from an attentive reading that there is a striking contrast in trustworthiness between the measures of the different factors, a natural corollary of the somewhat chaotic state of British statistics which is made the subject of an eloquent complaint in the introduction. One might quarrel with the author's decision to exclude from national income internal payments on government debt, although there is eminent precedent for it and the figures in question are presented. A more serious criticism relates to the character of the discussion which suffers from faults all too common in the literature on national income. The text is a mixture of brief notes on the methods and sources employed, with a few comments on the significance of the results. The description of methods and sources is in many cases all too scanty to be of use to any interested technician, this being especially true of the estimates covering the production side of income. But it is too comprehensive for the non-technical reader who is interested in the results and their interpretation. It might have been more advisable to carry the explanation of methods into a separate part of the book and organize the description of sources somewhat more systematically, to permit convenient reference.

All in all, it is an assiduous, and often brilliant, attempt to fit a vast body of heterogeneous data into a consistent picture of a country's national income over a disturbed period. Mr. Clark covers a much wider canvass than the earlier investigators in the field (Bowley, Stamp, and Flux) especially in the complete-

ness with which he traces the flow of income from its industrial sources to the channels of expenditure and saving. And if at some stages of the inquiry, data are strained perilously close to the tolerance point, the effort should nevertheless be accorded full credit. It is an effective stimulus toward further analysis and enrichment of available information as well as toward quantitative testing of some widely current economic generalizations.

SIMON KUZNETS

National Bureau of Economic Research

A Decade of Corporate Net Incomes, 1920 to 1929, by S. H. Nerlove. Chicago: The University of Chicago Press. 1932. ix, 76 pp.

This short monograph consists of ten chapters on the "size and behavior" of corporate "gross" and "net incomes" in the United States over the period 1920–29. The statistical material rests mainly on data published by the Bureau of Internal Revenue in its annual *Statistics of Income*. The analyses run principally in terms of "all corporations," that is, all manufacturing, trading, financial, construction, utility and other industrial groups are treated as a unit, although for four broad industrial divisions (mining, manufacturing, construction, trade) some separate figures are given.

The statistical findings indicate that the "gross" income of all corporations increased from about 122 biliion dollars in 1920 to 159 billion in 1929. "Gross" income, as the author uses the term, is a hybrid figure which merges the sales of manufacturing corporations with gross profits from the sales of stocks, bonds, real estate, etc. obtained by manufacturing, financial and other types of corporations. Accordingly, the reviewer can scarcely agree that "annual changes in corporate 'gross' incomes offer a measure of fluctuations in the value of corporate goods and services exchanged" (p. 4) . . . which "is reliable" (p. 5), unless one includes the changing prices and volume of corporate securities in his definition of "goods and services exchanged." It may be that Professor Nerlove has made allowance for this factor of sheer security inflation—particularly as reflected in the "gross" of various financial corporations as against manufacturing, trading and other corporations—but none appears in the discussion. In its absence, however, changes in "gross" from one year to the next are not conclusive as to changes in goods and services.

Corporate net income, Professor Nerlove finds, grew from about six billion in 1920 to nearly ten billion in 1929. Annual changes in net income are found to correlate with both changes in the physical volume of production and the wholesale commodity price level, especially with the former. Three chapters analyze the course of net incomes and the relation of "net" to "gross." Other short chapters treat of net incomes and invested capital, the compensation of officers, Federal income taxes, and the reinvestment of income.

The study seems more competent statistically than interpretatively. It is, for example, said (p. 38) that all corporations for the whole period 1920–29 averaged net earnings of 6.6 per cent upon invested capital (which is estimated) the

annual figure varying between 1 and about 8.3 per cent. A note then remarks that this "seems to justify the 'rule-of-thumb' figure often used by rate-making bodies, i.e., 6–8 per cent." Hardly! The data which average 6.6 per cent are for all corporations in the country—large, small, profitable, unprofitable—and in all industries. Some are subject to severe competition, some have virtual monopolies. To say that the *average* return for several hundred thousand heterogeneous enterprises of all types from small closely held trading concerns to the General Motors Corporation *justifies* the prevailing practice of rate-making bodies is scarcely defensible, even in a footnote! In the text of the same chapter, and in connection with the same figure of 6.6 per cent, appears a similarly quick conclusion. It is stated that "the yield on high-grade bonds during the same period averages approximately 4.5 per cent. . . . The payment for the risk involved in furnishing capital to industry on the basis of equity contracts instead of fixed income contracts was, then, on the average approximately 2 per cent annually" (p. 39). The bond yield used, it shortly appears, is Frederick R. Macaulay's index of rails (National Bureau of Economic Research). To hold that the discrepancy between the yield of *high-grade, railroad* bonds and an *average return* of 6.6 per cent on the estimated capital investment of all kinds of industries and corporations indicates the payment for risk involved by "equity-contracts" instead of fixed "income-contracts" is far too easy a disposal of the vexing question of interest *versus* profits. Many of the corporations included in this average figure have no bond issues at all; indeed some entire industries have scarcely any. To lump all corporations together and then reason from a highly abstract average result ignores too many considerations. Professor Nerlove in one or two places cites Hayek's *Prices and Production*. He would have done well to recall Hayek's criticism of the use of general average figures for interpretative purposes.

But it is easier to compile and analyze than to interpret; of this the reviewer is only too well aware. If, on the whole, Professor Nerlove's essays at interpretation have been unfortunate, his task of compilation and analysis has been well performed; and his monograph none the less constitutes a worth-while contribution to an increasingly important field.

RALPH C. EPSTEIN

University of Buffalo

Trusteeship of American Endowments With Comparative Analyses of the Investment Experience of Leading Universities, by Wood, Struthers and Company. New York: The Macmillan Company. 1932. xiv, 156 pp.

The question of management of investment funds belonging to American universities and other endowed institutions has for a long time past presented one of the most interesting problems in the field of trusteeship. This problem has become acute with endowed as it has with financial, institutions and, indeed, with all trustees since the opening of the depression. Messrs. Wood, Struthers and Company, experienced investment specialists, have prepared a careful study

of the conditions which exist among endowed institutions in the United States, "in the hope that it will be definitely helpful to individual and corporate Trustees, and to all those Trustees of religious bodies, educational institutions, hospitals, foundations, organized charities, and other cultural and humanitarian organizations for which the lengthening depression has created serious or desperate situations."

The outcome of the study shows great variation in experience but the authors state that they have portrayed investment practices which have been detrimental with the same fidelity as those which have been favorable, the outcome being a rather unusual survey of American endowment finances hardly to be duplicated elsewhere. The book closes with an actual list of bonds and stocks held by five or more universities or colleges designed to show the performance of institutional investments, while a reference to the text shows in each case the extent to which these securities have actually proven a satisfactory reliance. Needless to say, the general showing that results from the text is not very encouraging, and shows why it is that many institutions are finding it currently necessary to reduce salaries or staffs, or both. The authors close their treatment with the remark that "In practice no two Boards of Trustees seem to pursue the same methods in handling their funds . . . though fundamental rules governing the investment and management of permanent funds change but little, the ideal investment policy for general use has not yet been framed." Nevertheless "a consistent investment policy, adapted to the specific purposes of the endowment, is an indispensable preliminary to the successful building of any permanent fund." The inference to be drawn from these remarks is that although general principles of investment are well enough known, their application in every given case is a matter requiring expert assistance.

Perhaps the most serious criticism to be made upon this study is the fact that it is as highly specific and detailed as it is, yet offers so little in the way of general advice and suggestion. It would require a fairly qualified student of investment banking to read it with more than superficial instruction. Nevertheless, it should prove materially helpful to institutional investors as a record of the policies of their contemporaries. There is much in it that may serve as the corrective material upon which to found an improved investment policy for use by those who in the past have been disposed to work without any very positive guiding principle.

H. Parker Willis

Columbia University

Communication Agencies and Social Life, by Malcolm M. Willey and Stuart A. Rice. McGraw-Hill Book Company. 1933. 214 pp.

This study is one of a series of monographs published under the direction of The President's Research Commission on Social Trends. Its scope is confined to the development and utilization of the media of transportation and communication, their interrelationships and their social effects. The monograph is in

three main parts. The first deals with agencies of transportation—railroads, highways, water and air—and their utilization in the actual movement of persons; the second with "point to point" communication—the postal service and several forms of service by wire or wireless—providing indirect or mediated contacts between individuals; and the third part discusses the agencies of mass impression—newspapers and periodicals, motion pictures and radio broadcasting—whereby from a single source many separate individuals are stimulated simultaneously.

The purpose of the volume is to trace the changes in the utilization of each, how a change in one affects others, and how human habits are influenced thereby. The main thesis is that, in terms of transportation and communication, the distance between coasts has shrunk to a degree beyond the imagination of our forefathers. Such shrinkage necessitates social adaptations throughout the entire country. In the economic world it brings problems of organization, both in production and distribution. The localized market has expanded to embrace a continent. The urge to large-scale production, mergers and consolidations cannot be understood fully unless they are related to the expansion of the facilities of transportation and communication. Similarly, in the field of government, centralization of functions and the declining importance of small, localized units of administration are related to the development of the contemporary communication network.

The discussion throughout is almost exclusively from the sociological viewpoint. Little attention is paid to operating technique; the emphasis is placed upon the trends in results. In so far as transportation is concerned no consideration is given to the movement of commodities although it is obvious that there is sociological import also in improvements in the speed, regularity, adequacy and economy of freight transportation.

In the section relating to passenger transportation by railroad, the substantial decline since 1920 is attributed mainly to the intrusion of a new agency—the motor car—into the field theretofore largely monopolized by the older agency, and the suggestion is made that correlation between the two is socially desirable. As to electric railways, we are reminded of the period early in the century when the trolley car served for pleasure trips as well as necessity travel. The pleasure function disappeared with the advent of the automobile. The number of passengers carried by electric railways in large centers of population has not fallen off but the total for all communities, influenced by the substitution of the bus in smaller communities, shows a substantial decline since 1922.

The social significance of the automobile is emphasized by the statement that probably no innovation of such far-reaching importance had ever before been disseminated with such great rapidity. The importance of the automobile as a commercial passenger transportation agency is greatly transcended by its importance as an agency of private passenger transportation. The freedom of control within the individual and the almost unlimited potential mobility of the automobile have revolutionized traveling habits. Local communities are being more closely knit into regional urban areas and man's personal contacts in remote

communities have been multiplied enormously. The automobile has rendered local administration of highways practically obsolete and has brought about state-wide and national highway planning under centralized state and federal control. Improved highways have been made necessary by the motor vehicle and the better roads have increased the use of such vehicles.

An analysis of the available statistics leads the authors to conclude that longer journeys by more people are now made with relatively greater frequency than ever before, with an even greater intensification of mobility within circumscribed local areas. Contacts within the community are multiplied out of proportion to contacts at a distance. The more frequent distant contacts may be destructive of provincialism, but the still more intensified local contacts may serve to foster it.

Classified as "point to point" communication are the postal service and services by wire or wireless. Attention is called to the fact that the postal services, notably through the development of rural free delivery, have been brought to the doors of a continuously larger portion of the population. The data reveal in general an increasing frequency of contact between individuals. The growth and improvement in telegraph service have been overshadowed by the extension and more general use of the telephone. Of especial interest are the statistics which reveal the trend in yearly telephone calls per capita, the division of such calls between local and long-distance, and the conjectural observations on social effects. One of these is that the more frequent contact tends toward brevity and impersonality and may result in loss of those values that inhere in more intimate, leisurely and protracted personal discussion. Devices that permit speed in turn induce it.

Under the heading of agencies of mass impression are presented and analyzed comprehensive statistical data relating to the number, circulation, ownership and character of newspapers and periodicals, and the volume of advertising matter; the number of motion picture theaters and the nature of the pictures; and the development of radio broadcasting, the ownership of receiving sets, and the organization of the chain broadcasting companies. Social mechanisms now exist whereby it is possible to impress the people of an entire country simultaneously, involving far-reaching effects upon social attitudes and behavior. Such a communication system is both terrifying and inspiring in its potentialities —terrifying because of the possibilities it opens for the accomplishment of selfish ends and inspiring for its potentialities of social self-control.

The residual impression gained from the survey is of individuals at the focal points of interrelated social stimuli that are continuously impinging upon them from the world about. During thirty years the number and intensity of these stimuli have increased, the boundaries within which they arose have expanded, while the speed with which they were transmitted has accelerated. Among these interwoven stimuli there appear to be two contradictory tendencies. One is the reinforcement of community patterns of attitude and behavior, resulting from multiplication of contacts with others in the same community. The second is standardization over wider national and international regions. The first ten-

dency makes for the perpetuation and intensification of localism. The second appears to undermine localism and obviously does so in certain externals. The conclusion of the authors is that both of these opposing factors are concurrently effective because they are selective in their application. An increase in overt standardization may be accomplished by retention of inward differences.

Professors Willey and Rice have performed their task with skill, and have produced an authoritative, interesting and thought-provoking volume. The book is a real contribution to the scant literature in the special field of sociological implications of transportation and communication.

WILLIAM J. CUNNINGHAM

Harvard University

The Distribution of Consumable Goods, by Dorothy Braithwaite and S. P. Dobbs. London: George Routledge and Sons, Ltd. 1932. xiii, 304 pp.

The Consumer, His Nature and Changing Habits, by Walter B. Pitkin. New York: McGraw-Hill Book Company. 1932. xiii, 421 pp.

These two books have little in common beyond the superficial similarity suggested by their titles. They are strikingly different in style, content and scholarly character. If the first is more of a tribute to British scholarship than the second to American, it may be partially due to the fact that "consumable goods" lend themselves to study as "consumers" do not. In fact so elusive is the "nature of consumers" that the favorite method of approach is through the study of the goods they use. Unfortunately this method as hitherto applied throws more light upon the goods than upon their users.

The Distribution of Consumable Goods is also quite unlike the majority of American books on marketing. The latter tend to concentrate on the description of actual trade practice and organization. Mrs. Braithwaite's intention, however, was not so much to fill a gap in descriptive economics as "to examine in the light of accepted economic principles the structure and functions of the distributive machine." Her work therefore with its distinctly economic approach should be especially valuable and stimulating to American students of marketing.

The inquiry represented by this book was begun by Mrs. Braithwaite while she was a student of economics at Cambridge. After her untimely death in 1928, Mr. S. P. Dobbs who also received his economic training at Cambridge was asked to complete the manuscript and prepare it for publication. Those who had noted Mrs. Braithwaite's article "The Economic Effects of Advertising" in the *Economic Journal* for March, 1928, will be glad to find it as Chapter VII of this book. Chapter III entitled "Information" serves as a foundation for Mrs. Braithwaite's thesis that advertising is on the whole injurious to the community.

Mr. Pitkin warns the economist, the business man and the psychologist that his book will bewilder them. He says also with truth that they will even find much in it that seems irrelevant and perhaps absurd. The lay reader may

however, he says, dip into it with neither fear nor confusion. But even the lay reader will be disappointed if he hopes to learn here of the "nature" of the consumer, that is, the nature of his wants and their relationships. Mr. Pitkin, as many others, finds it easier to discuss "Factors Limiting Volume Consumption," and "Classes of Consumers," Books III and IV, occupying three-fifths of the total space. Other sections are "How Wealth Accumulates," "The Web of Life," "The War between Maker and User."

The best parts of the book in the reviewer's opinion are the shrewd and penetrating comments that are found scattered through its pages. For example, "Most evils can be warded off only through stiff teamwork, but most good things can be sought and enjoyed only according to individual interest and taste." (Page 401.) A sample of the worst is the following: "The average mark-up on goods by retailers is 25 per cent in the United States; and retail purchasers take about half of all personal incomes in the country. On the basis of a fairly good year, then, when incomes would run up toward $75,000,000,000, we would be paying out $9,375,000,000 for the cost of retail distribution. . . . Most of this vast sum is, in strictly economic accounting, sheer waste. And the fault lies less with the retailer than with woman the economic imbecile who buys from him. This has often been shown without making the slightest impression on women, who never read economic studies and never would practice their teachings, even if they did read them." (Page 281.)

HAZEL KYRK

University of Chicago

Neighborhood Distribution and Consumption of Meat in Pittsburgh, by John H. Cover. Chicago: University of Chicago Press. 1932. 228 pp.

This is an intensive study of the merchandising of meat in representative neighborhood stores in Pittsburgh. The influence of income, size of family, racial and religious tradition, occupation, other food purchases, shopping methods and the rationality of purchasers are among the outstanding purposes sought. Data are presented on the percentage which shop by telephone, pay cash, have the meat trimmed, inspect the scales. The exact proportion of meat in the food budgets in the different neighborhoods, the cuts purchased and typical menus are presented.

While the book may be of some practical value to meat merchants, it arrives at conclusions which will not startle those who are aware that poor people must buy inexpensive cuts, that rich people have greater variety, that most people are not thoroughgoing rational calculators, that many small merchants use old-fashioned methods, that some shops are clean and others are not. The most important question raised by the book is the practical or methodological value of elaborate surveys for unimportant ends.

GUSTAV PECK

The Principles of Financial and Statistical Mathematics, by Maximilian Philip. New York: Prentice-Hall. 1932. xx, 406 pp.

Previous books on the Mathematics of Finance have confined themselves to the application of mathematics to business problems and contained no topics of a solely mathematical character save the usual chapters—either in the text or in the appendix—on logarithms, series and probability. The student in the college of arts, and often the one in the college of commerce, is required to obtain his necessary knowledge of arithmetical and algebraic manipulations by taking courses in College Algebra and Analytical Geometry.

This text written for "the use of commercial divisions of colleges and universities" requires no previous mathematical training. Containing material for a year's course, it is divided into three parts:

Part I. Basic Methods of Calculation
Part II. Mathematics of Finance
Part III. Analysis of Statistical Data

Doubtless one would think it unnecessary, under our modern system of secondary education, to review arithmetic and ninth grade algebra; but anyone who has taught the ordinary college freshman knows that, in the years intervening from the ninth grade, most of his mathematical knowledge has departed. Consequently, the author, in a most satisfactory manner, has presented in Part I a review from the very beginning of those operations of arithmetic and algebra that one should know in order to simplify calculations. This part also includes good discussions of graphs, quadratic equations and logarithms. An interesting topic is the construction of a logarithmic table from a table found by successive square root extractions of the number 10.

In Part II one finds chapters on compound interest, annuities, bonds and mortgages—the latter topic especially should be mentioned. This part of the book is simply written, stressing the fundamental principles and the understanding of the ideas rather than the development of formulas to solve everything of which one might think. Sections on the binomial theorem, Newton's method of interpolation and a chapter on series conclude this section of the text.

While Part II discusses its topic completely enough, Part III is only "an introduction to the methods used in analyzing statistics." The material includes both the graphical and analytical transformations which send a parabola, an equilateral hyperbola or an exponential curve into straight lines. The method of least squares is developed to get the equation of the best fitting line or parabola, as well as to write the equations of the regression lines of a correlation table. The usual chapter on probability is followed by one giving the essentials of life insurance. The arithmetic mean, the standard deviation and the coefficient of correlation enter incidentally—no other average, measure of dispersion or measure of relationship is mentioned.

J. R. Musselman

Western Reserve University

The Methods of Statistics, by L. H. C. Tippett. London: Williams and Norgate, Ltd. 1931. 222 pp.

Tippett's excellent book covers a wide range of topics in a most concise manner. The examples and applications given are drawn almost exclusively from the field of biology. The author's own description of the book is terse:

> The first chapters deal with frequency distributions and constants, and with the theory of errors, in orthodox manner, but in the later chapters the underlying theme is Fisher's idea of the Analysis of Variance; correlation is introduced as a special case of this. There are, of course, other ways of regarding the subject, but its unity seems to me to be brought out more by this than by any other method of presentation.

He further says, "I have given mathematical proofs where they are easy; but where they are not, I have not hesitated merely to state the results."

In addition to the Gaussian curve, attention is given to the fitting of binominals and Poisson series, but other non-normal curves are dismissed for, in biology, "It is not often in practical work . . . that any useful purpose is served by fitting such curves . . ." This is something of a disappointment to the reader interested in the social sciences.

The chapter on the theory of random sampling has much merit. He recognizes that the adoption of the .05 level of significance is quite arbitrary and adds that ". . . many investigators prefer a severer criterion (say a probability of .01)." No reason, however, is given for the adoption of either of these. Since it is quite possible that for different types of problems the investigator may wish to adopt different levels of significance, it follows that the invariable use of the .05 level may not be desirable.

Instead of following the Fisher procedure of discussing small samples in conjunction with the various measures, Tippett presents a separate chapter on small samples and observes that the "methods applied to small samples make the interpretation of the data as exact as do the . . . methods applied to large samples." A chapter is devoted to the sampling distribution of the correlation coefficient. Here it is noted, "Contrary to an opinion often expressed, an association measured by the correlation coefficient may be significant in a very small sample if it is strong enough; and this is in accordance with common experience."

Though the pages seem a bit too heavy for the binding, the make-up of the book is otherwise excellent.

FREDERICK E. CROXTON

Columbia University

How to Budget Health, by Evans Clark. New York: Harper and Brothers. 1933. 328 pp.

This book discusses the present situation in medical care, and advocates "medical guilds" as a way out. The guild idea has two essential elements: (1) an all-around medical service including hospitalization and dentistry furnished by a balanced group of salaried physicians, dentists and nurses, and (2) pay-

ment for this service through a fixed annual fee. The guilds are to be private but non-profit organizations, and are most likely to come into existence from the "producer" side, i.e., by a number of physicians pooling their practices and offering their services, as needed, for a flat charge per year. But an association of consumers might also organize a guild by building or purchasing a hospital, and employing the necessary medical personnel.

This proposal, of course, is by no means original with the author. The same arrangement, though under different terminology, was recommended by the Committee on the Costs of Medical Care, and numerous variations of the guild idea, as in some industrial medical services, are already in existence.

A host of studies in the field of medical care has demonstrated the validity of two propositions: (1) a group of salaried physicians, practicing in close cooperation with one another, and utilizing equipment and subsidiary personnel in common, can render better service and at less cost, than the same number of physicians in private, independent practice; and, (2) the costs of medical treatment in cases of severe illness have become so great that if people are to be able to meet them the burden must be distributed through insurance. The facts leading to these conclusions are well presented by the author. But having come thus far, the real problem consists in devising workable arrangements which will embody the two principles of group practice and insurance.

The medical guild here proposed is one possible arrangement. As a solution for the medical problems of the mass of the population, it has the defects of voluntary health insurance. Abroad, the experience has been that voluntary insurance is all right as far as it goes, but that it never goes very far. If the bulk of the working class is to derive the benefits of insurance, there must be legal compulsion to insure. Furthermore, the basic fact in the whole medical situation is that the lower third of the population was too poor, even before the depression, to be able to pay the cost of adequate care. Mr. Clark recognizes this and suggests the necessity of public subsidy. But if the government foots the bill to this extent, it is likely to demand a greater measure of control than is compatible with the plan of privately organized guilds.

A basic difficulty besetting the guild proposal is that in order to get subscribers or patients, the guild may be forced to advertise and to solicit patronage, thus causing its physicians to do as a group what no ethical physician is willing to do as an individual. Furthermore, the establishment of a number of guilds in the same community raises the unpleasing prospects of competition, rate cutting and commercialization. It is these dangers which have caused the organized medical profession to oppose all such forms of practice. The guild plan seems much more practical for a small community with but a single hospital and where all the physicians in the community could be brought into the scheme, than in a large city where many guilds would be necessary.

The whole medical situation is in a state of flux. If one can be sure of anything it is that in years hence people will obtain medical service through other economic arrangements than private practice on a fee-for-service basis, and that no one arrangement will suit the needs of all groups and all communities.

The medical guild plan has promise for some groups and some communities. And in the course of putting the case for it, Mr. Clark has made a most excellent review of the whole problem of medical care, and of the findings of recent investigations in this field, including those of the Committee on the Costs of Medical Care.

LOUIS S. REED

Statistical Methods for Research Workers, by R. A. Fisher. Fourth Edition. Edinburgh: Oliver and Boyd. 1932. xiii, 307 pp.

Important additions and modifications have been made in this edition of Dr. Fisher's authoritative manual. A new section on "The Analysis of Covariance" shows how the results obtained by the analysis of variance may be modified upon eliminating the effect of extraneous variables by a regression equation. The example used is of the analysis of variance of yields in a square array of agricultural plots, these being corrected for their yields in the previous year by a linear regression equation. The economic statistician will be more particularly interested in the examples of the analysis of covariance given by A. L. Bailey in this JOURNAL for December, 1931, which however are identical in principle.

While Dr. Fisher discovered some years ago the exact sampling distribution for the ratio of independent variances, and has tabulated it in this book, the corresponding distribution for the ratio of covariances is still an outstanding mathematical puzzle. However, a substitute for such a ratio suitable for some uses is the ratio of determinants whose elements are the covariances, variances appearing in the principal diagonal. The moments of such determinants and of their ratios, and to some extent the distributions, were discovered by S. S. Wilks, and appear in a recent issue of *Biometrika*. This work of Dr. Wilks will call for consideration in further development of technique in the analysis of covariance.

A change of great interest and importance appears in this edition in the treatment of moments, skewness, and kurtosis. In place of the moments of the sample, Thiele pointed out the advantages of using certain functions of them which he called half-invariants. This name has been changed by later writers squeamish about the mixing of Latin with Teutonic roots into semi-invariants or seminvariants, tongue-twisting and unsuitable words which have a conflicting meaning in the theory of algebraic curves. The meaning has also been obscured by a confusion between sample and population values. The mean in an infinite population of the values of one of Thiele's half-invariants in all possible samples of n is not the population value of the half-invariant, but differs from it by terms of order $1/n$. To straighten out the tangle, Dr. Fisher in this edition introduces a completely new system of notation. The *population* values of the half-invariants are called "cumulants," a name suggested by this reviewer. The estimate of a cumulant from a sample of n involves n in such a way that the mean value is identical with the cumulant estimated. A powerful method of dealing with the sampling errors of these estimates was introduced by Dr. Fisher in a paper published in 1929 in the *Proceedings of the London Mathematical Society;* the results are immensely more elegant than those for moments or for half-

invariants. In terms of the cumulants, the book gives a more accurate method of dealing with skewness and kurtosis than has heretofore been known.

Another valuable new section deals with the combination of independent tests of significance. This is accomplished by passing from the probability P of a greater discrepancy in each test to χ^2 by means of the equation $P = e^{-\frac{1}{2}\chi^2}$, adding the resulting values, and treating the sum as a value of χ^2 with twice as many degrees of freedom as there are tests. This seems to require the use either of a more detailed table of χ^2 than is given in the book or of a table of *natural* logarithms. The latter table is indeed needed by the user of Fisher's table of the analysis of variance distribution; but it is to be hoped that a probability table for the ratio of variances itself, rather than for its natural logarithm, will eventually be forthcoming.

A much improved method, devised by Brandt and Snedecor, is given for calculating χ^2 from a $2 \times n$ table. A brief note on the history of statistical theory has been introduced. The statements on pages 78 and 235 as to when Sheppard's corrections should *not* be used are of more than passing interest. The book remains an indispensable handbook for the practical statistical worker.

HAROLD HOTELLING

Columbia University

A Standard Classified Nomenclature of Disease, edited by H. B. Logie. New York: The Commonwealth Fund. 1933. xvii, 702 pp.

A long step in advance has been taken toward securing comparable morbidity statistics. A new nomenclature of disease has been compiled by the National Conference on Nomenclature of Disease, organized in 1928 with the object of uniting the important national societies representing medicine, surgery and their specialties, the federal medical services, national health organizations and life insurance interests. The American Statistical Association was represented on the executive committee of the Conference by George H. Van Buren. This volume is the result of years of coöperative effort.

In the past, hospitals, health organizations and insurance companies have been obliged to devise their own nomenclatures, or to modify existing classifications to suit their special requirements. Confusing diversity was the result, ranging from simple alphabetical lists to elaborate classifications of diseases, based upon anatomical, etiological, functional or epidemiological considerations. As a result, comparable and adequate morbidity statistics from hospitals and health institutions in the United States have been impossible. When the results of the coöperative, national effort in standardizing the classification of diseases have been generally adopted a mass of really comparable hospital data on sickness will become available.

The new nomenclature provides for a dual classification, on an anatomical and on an etiological basis, each logically consistent and complete, devised by Dr. Logie, Executive Secretary of the Conference and Editor of this volume. Thus, tuberculosis is classified as a disease of the lungs or of the bones, and also

in etiological terms. For the first time, this scheme provides for the compilation of *all* diseases which attack a specific organ. Under the system secondary as well as primary diagnoses are recorded, and, in case of death, the *Manual of Joint Causes of Death* (Bureau of the Census) is the accepted guide for classification.

A group of large and small hospitals installed the new system in their record rooms for a trial period of six months in 1932, before final publication. This made possible the correction of errors and omissions before general adoption. More than twenty clinical societies have given the nomenclature their formal approval, and it has been adopted by some of the largest hospitals in the country. The alphabetical index at the end of the volume is very comprehensive, and will greatly facilitate its use as a reference work by clinicians, public health officials and recording offices. Code numbers are supplied, and their derivation and method of use are explained in the Introduction, for the convenience of large hospitals and for organizations such as the federal services, the insurance companies, and health departments, which employ a punch-card system for tabulating morbidity statistics. It is planned to keep the classification constantly abreast of the progress of medicine, which will require frequent revisions in the detailed categories.

ROBERT E. CHADDOCK

Columbia University